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# ENVIRONMENTAL ASSESSMENT BOARD



## ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARINGS

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VOLUME: 141

DATE: Monday, May 4, 1992

### BEFORE:


HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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ENVIRONMENTAL ASSESSMENT BOARD  
ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARING

IN THE MATTER OF the Environmental Assessment Act,  
R.S.O. 1980, c. 140, as amended, and Regulations  
thereunder;

AND IN THE MATTER OF an undertaking by Ontario Hydro  
consisting of a program in respect of activities  
associated with meeting future electricity  
requirements in Ontario.

Held on the 5th Floor, 2200  
Yonge Street, Toronto, Ontario,  
Monday, the 4th day of May,  
1992, commencing at 10:00 a.m.

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VOLUME 141  
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B E F O R E :

THE HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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1       ---Upon commencing at 10:02 a.m.

2                   THE REGISTRAR: Please come to order.

3       This hearing is now in session. Please be seated.

4                   THE CHAIRMAN: Ms. Harvie?

5                   MS. HARVIE: Mr. Chairman, we have two  
6 matters to bring to your attention, one Mr. Johansen  
7 will be speaking to with regard to an issue that arose  
8 during Northwatch's cross-examination, and the other  
9 that I will be speaking to, and that is the definition  
10 of passivity that arose during Ms. McClenaghan's  
11 cross-examination of this panel.

12                   On Tuesday, April the 14th in Volume 133  
13 of the transcript you'll find a discussion regarding  
14 passivity and at the time Mr. King was being asked to  
15 define it and he referred to the EPRI definition and  
16 noted that it was not on the record, and Dr. Connell  
17 asked if it could be put on the record and no one  
18 responded to him at the time, but we have followed up  
19 with that.

20                   In addition to that, later on in the page  
21 you will see a discussion of the definition of the IAEA  
22 definition of passivity. So we have excerpts from both  
23 of those documents that we would like to file as  
24 exhibits.

25                   THE CHAIRMAN: All right. Why don't we

1 do that.

2 MS. HARVIE: I will just leave additional  
3 copies here for the parties to pick up.

4 THE CHAIRMAN: All right.

5 MS. HARVIE: And I'll make sure as well  
6 that Ms. McClenaghan gets a copy.

7 THE CHAIRMAN: The next exhibit number,  
8 please?

9 THE REGISTRAR: 652, Mr. Chairman.

10 THE CHAIRMAN: Thank you.

11 ---EXHIBIT NO. 652: Excerpt from EPRI and IAEA  
12 documents re: definition of passivity.

13 THE CHAIRMAN: Mr. Johansen, did you have  
14 something you wanted to put on the record?

15 DAVID WHILLANS,  
16 KURT JOHANSEN,  
17 FRANK CALVIN KING,  
WILLIAM JOHN PENN,  
IAN NICHOL DALY; Resumed.

18 MR. JOHANSEN: Yes, Mr. Chairman. With  
19 reference to transcript Volume 138.

20 THE CHAIRMAN: Just a moment. Yes.

21 MR. JOHANSEN: Page 24296. This was in  
22 the course of cross-examination by Mr. Greenspoon for  
23 Northwatch.

24 Beginning line 9, Mr. Greenspoon was  
25 putting to the panel - Dr. Whillans I think was being

1 cross-examined at the time - the following numbers  
2 pertaining to radioactivity content in mine tailings at  
3 Elliot Lake.

4 The passage which he read into the record  
5 there begins with one tonne of tailings has a  
6 radioactivity of 1.85 times 10 to the 8th becquerels,  
7 and he gives the equivalent in curies and suggests a  
8 total curies based on a total quantity of tailings  
9 which the consultant had earlier presented in the  
10 document which was in question here.

11 We undertook to check the values which he  
12 put to us in that paragraph. In particular on page  
13 24297 of the transcript Mr. Greenspoon asks us to let  
14 him know if we have any problems with those numbers  
15 prior to Dr. Resnikoff presenting us with his numbers,  
16 presumably referring to the evidence that Northwatch  
17 proposes to present later on in the hearings.

18 So we did check with our fuels people,  
19 and I apologize it took this long, but they were  
20 waiting for a confirmation from the uranium suppliers  
21 in turn and we just got the answer on Friday.

22 We were able to verify that the 5 times  
23 10 to the minus 3 curies per metric tonne figure which  
24 Northwatch put to us in that paragraph is indeed given  
25 in the 1977 paper by Moffett and Tellier as Northwatch



1 has indicated, however, I would like to say that in  
2 looking at that paper we were able to find it only in  
3 the preamble to the paper and couldn't see where it  
4 flowed from the work that the paper actually reported  
5 on.

6 So we interpret that to be a general  
7 figure which was presented or offered by the authors  
8 for general context and we couldn't determine that it  
9 was particularly representative of the tailings that  
10 they in fact studied.

11 The information we got from our fuels  
12 people based on feedback from the fuel suppliers at  
13 Elliot Lake indicates that a representative  
14 radioactivity value for tailings at the Stanleigh Mine  
15 is less than 40 million becquerels per cubic metre and  
16 I should comment that the number which I had earlier  
17 provided based on our radioactive materials management  
18 overview document, this is Exhibit 520.19, the value I  
19 had given was 10 million becquerels per cubic metre.

20 That was a value which we had obtained  
21 from the same people in the uranium and mining company,  
22 however, it was clarified to us that that number they  
23 had intended only as an average value for radium  
24 activity in the tailings and they explained that when  
25 taking all of the radionuclides into account that a

1 good number representative of the Elliot Lake tailings  
2 was 40 million becquerels per cubic metre as I said.

3 In addition, they advised that a typical  
4 density value for those tailings is 1.8 metric tonnes  
5 per cubic metre which is somewhat greater than the  
6 numbers that Northwatch had presented.

7 So taking those two numbers, 40 million  
8 becquerels per cubic metre and the density of 1.8  
9 metric tonnes per cubic metre, we calculate a specific  
10 activity for tailings in the Stanleigh Mine tailings  
11 disposal area of 0.22 times 10 to the 8th becquerels  
12 per metric tonne, which is roughly an order of  
13 magnitude less than the 1.85 times 10 to the 8th  
14 becquerels presented by Northwatch.

15 So we are not in a position to agree with  
16 the numbers, either the specific activity numbers nor,  
17 therefore, the total activity numbers presented by Mr.  
18 Greenspoon.

19 And finally, in reference to the page,  
20 that is page 47 of Northwatch's materials, where under  
21 table 2.2 there is a statement along the lines that  
22 these nuclides are dispersed, we would have to take  
23 exception to that as well.

24 And that is all I have to provide, Mr.  
25 Chairman. Thank you.

1 THE CHAIRMAN: Mr. Greenspoon isn't here  
2 today. I think you should make sure that this is drawn  
3 to his attention rather than he find it serendipitously  
4 in looking through the transcript.

5 MS. HARVIE: Yes, certainly, Mr.  
6 Chairman.

7 THE CHAIRMAN: Mr. Mondrow?

8 MR. MONDROW: Thank you. Mr. Chairman,  
9 Board Members, you'll be familiar with Mr. Jeff  
10 Passmore who is sitting beside me. Witnesses, I'll  
11 just introduce Mr. Passmore. He is the principal for  
12 Passmore Associates International.

13 Mr. Chairman, I have been through our  
14 material and I can advise that we should certainly be  
15 finished today, perhaps even by the afternoon break and  
16 that is allowing a reasonable time for response from  
17 the witnesses. It shouldn't be any problem.

18 CROSS-EXAMINATION BY MR. MONDROW (Cont'd):

19 Q. Mr. Johansen, when we broke Thursday  
20 we had just started to talk about wastes. You had told  
21 us that your plan for permanent disposal of non-fuel  
22 wastes was currently out of date and was currently  
23 being updated and is just around the corner.

24 Pending resolution of the permanent  
25 disposal problem you are handling most of your non-fuel

1 wastes at the Bruce Nuclear Power Development; is that  
2 correct?

3 MR. JOHANSEN: A. Yes, that's correct.

4 Q. So the OM&A costs for the waste  
5 handling and storage operations at BNPD then are  
6 allocated to the respective nuclear generation  
7 facilities?

8 [10:15 a.m.]

9 A. That would be my assumption, yes.

10 Q. And the OM&A costs from the outdated  
11 plan, which is to be updated for a permanent disposal  
12 facility, would those costs be allocated to the  
13 operating stations as well?

14 A. Subject to confirmation from Mr.  
15 Penn, it would be my assumption that, yes, they would  
16 be allocated to operations. Exactly how they are  
17 distributed amongst the different stations I couldn't  
18 tell you exactly. But they would be charged to station  
19 operations.

20 Q. And those costs, of course, will be  
21 updated when your updating plan is finalized?

22 A. Sure.

23 Q. I guess the things are actually  
24 getting a little tight at the waste storage and  
25 processing facilities at the Bruce Nuclear Power

1 Development since I understand there are a number of  
2 new facilities planned to be brought into service over  
3 the next little while. You touched on this with Mr.  
4 Poch a few weeks ago and you referred him to an  
5 interrogatory on the matter, and in fact we have that  
6 interrogatory in our package. I will ask you to turn  
7 up to page 20, please, of our package.

8 This is Interrogatory 9.14.13, which I  
9 believe, Mr. Chairman, needs a 520 number.

10 THE CHAIRMAN: I thought you referred to  
11 it earlier.

12 MR. MONDROW: Mr. Johansen had referred  
13 Mr. Poch to an interrogatory but not with reference to  
14 the specific number.

15 THE REGISTRAR: .137.

16 THE CHAIRMAN: Thank you.

17 MR. MONDROW: Thank you, sir.

18 ---EXHIBIT NO. 520.137: Interrogatory No. 9.14.13.

19 MR. MONDROW: Q. The response, Mr.  
20 Johansen tells us that the listing of facilities here  
21 are additional storage and processing facilities under  
22 consideration for the Bruce site. Could you quickly,  
23 please, update which of these facilities has in fact  
24 been approved or what the status of the considerations  
25 are?



1 MR. JOHANSEN: A. Yes, I will try.

2 Just as a general comment, I could say  
3 that these sort of additions have been going on for  
4 years, the facility is enlarged as required to  
5 accommodate the wastes from the growing nuclear system.

6 The first item under storage facilities  
7 listed there is the low level storage building No. 6,  
8 and that is simply another in a series of fairly  
9 conventional warehouse type facilities that have  
10 already been built there, there are five of them  
11 presently arranged contiguously so, in fact, they look  
12 like one single building but there are actually five  
13 modules. And that's indicated here as planned for  
14 in-service by April of 1993.

15 I am actually not certain whether the  
16 application for this and the other facilities listed  
17 here, whether the application for AECB approval has  
18 gone in or not as of this moment. If it hasn't been,  
19 it certainly will be very shortly.

20 Q. Okay.

21 A. The in-ground storage containers, the  
22 second item on the first list, were committed  
23 previously and I guess this is just indicating that as  
24 of -- in fact, as I recall, they were first in-service  
25 in 1989. So what we are seeing here is simply the



1 completion of an action to expand these in-ground  
2 facilities some time earlier.

3                   These are similar to the tile holes that  
4 I referred to in my direct evidence, simply a little  
5 bit deeper, roughly 18 cubic metres capacity each,  
6 hence the name IC18, and these are intended for type 2  
7 or type 3 radioactive wastes. So these are already  
8 in-service.

9                   The third item, the in-ground storage  
10 containers, type IC57s, are also part of the expansion,  
11 the near term expansion, and I believe these have  
12 already been approved. These are containers with a  
13 capacity of, it says 57 but I believe it's actually 58  
14 cubic metres, planned for storage of retubing wastes  
15 from Bruce "A".

16                   Listed under that, under the heading  
17 Processing Facilities are two items, firstly the  
18 radioactive waste incinerator and, secondly, the super  
19 compactor. These are two components, the two main  
20 components I might add, of the waste volume reduction  
21 facility. And these have not yet been approved by our  
22 own board of directors and therefore obviously not the  
23 Atomic Energy Control Board.

24                   They are still being reviewed as to  
25 technical and economic feasibility, and once that

1 analysis has been completed and if our board of  
2 directors decide to approve it, an application would  
3 then go forward to the Atomic Energy Control Board.

4 Q. I take it that these last two  
5 processing facilities would be helpful in light of the  
6 site at Bruce becoming rather full with wastes, or at  
7 least the built up part of the site; is that fair?

8 A. Yes, they are seen as improvements  
9 over the existing facilities. We don't presently have  
10 a super compactor and the super compactor referred to  
11 here would certainly significantly increase the volume  
12 reduction capability of that facility. And the  
13 radioactive waste incinerator upgrades that are  
14 envisaged here would bring the efficiency of the  
15 existing incinerator up to what it was intended to be  
16 at the outset. It, in fact, never did achieve the  
17 reduction efficiency that it was intended, and the  
18 purpose of the upgrade primarily is to get the facility  
19 back to its design capacity.

20 Q. I understand that radioactive liquid  
21 wastes are currently stored on-site at the various  
22 generating stations but that there are plans for a  
23 centralized storage facility for those as well; is that  
24 correct?

25 A. Yes. They would eventually be

1 solidified and managed at the Bruce facility.

2 Q. And are the operating costs for those  
3 additional facilities, those we have gone through in  
4 the interrogatory and the radioactive liquid waste  
5 facility, included in the OM&A projections that we saw  
6 in your overheads, the 1 per cent constant dollar per  
7 year?

8 A. Well, maybe I should defer to Mr.  
9 Penn because I believe he knows more about this than I  
10 do.

11 MR. PENN: A. Well, the cost of the  
12 facilities would be capitalized in the first place to  
13 put them in-service, and then form part of the  
14 depreciation of the Bruce waste management centre. And  
15 the cost of handling and transporting and processing at  
16 the NPD of this waste would be part of OM&A and would  
17 be chargeable -- I am not sure whether they are charged  
18 directly according to volume and nature to each of the  
19 nuclear generating stations, or whether the nuclear  
20 generation branch has an overall OM&A account for  
21 dealing with all wastes. But anyway, it's charged to  
22 OM&A.

23 Q. Are the costs currently incorporated  
24 into your projections for OM&A costs?

25 A. Yes, they are.

1                   Q. Mr. Johansen, some of the irradiated  
2 fuel bays where you store used fuel are also getting  
3 pretty fuel; is that right?

4                   MR. JOHANSEN: A. Yes, some of them are  
5 going to be filling up within the next couple of years,  
6 I would say, at Pickering, they are the first one.

7                   Q. Could you explain for us the term  
8 "re-racking" please?

9                   A. It's basically a rearrangement of the  
10 storage containers within the storage bays to obtain a  
11 more efficient storage arrangement, in effect, taking  
12 or making better use of the storage space that's  
13 available there already.

14 [10:23 a.m.]

15                   Q. So that you can get more used fuel  
16 stored?

17                   A. Yes.

18                   Q. For example, the early storage trays  
19 that we used initially - maybe I should just check my  
20 data - but there have been considerable improvements in  
21 storage efficiency over the years.

22                   The initial storage baskets, I guess they  
23 were called, provided or required more space than the  
24 latest storage modules which I have referred to before.  
25 The baskets provided -- a cubic metre of storage space

1 in the pools provided for 70 bundles, the current  
2 modules that we use allow for 110 bundles per cubic  
3 metre. So there has been a significant improvement in  
4 storage efficiency and that's the sort of thing we are  
5 talking about.

6 Q. Could you open page 25 of the  
7 interrogatory package, please. This is interrogatory  
8 9.17.8 which I believe, Mr. Chairman, needs a new  
9 number.

10 THE REGISTRAR: .138.

11 THE CHAIRMAN: Thank you.

12 ---EXHIBIT NO. 520.138: Interrogatory No. 9.17.8.

13 MR. MONDROW: Q. And, Mr. King, you just  
14 mentioned that Pickering is getting full and in fact  
15 you have already re-racked Pickering, and if we look at  
16 the question, the Porter Commission felt that the  
17 storage space at the Pickering fuel bay could have run  
18 out in 1988, and the response tells us that the  
19 restoring of the fuel, in the last sentence of first  
20 paragraph, delayed the need for additional storage at  
21 that station until the mid-1990s.

22 And then if we look at the table we see  
23 that Pickering "A" and Pickering "B" and Bruce "A"  
24 respectively are estimated to be full in 1995, 1993 and  
25 1997 respectively.



1 MR. JOHANSEN: A. Yes, that's right.

2 Q. Are those dates all after the  
3 re-racking?

4 A. Yes.

5 Q. And the same then with Bruce "B" in  
6 2000 and Darlington in 2008?

7 A. Yes. Those latter two dates have  
8 subsequently been reviewed and I believe the latest  
9 dates are 2003 for Bruce "B" and 2010 for Darlington,  
10 and those revised dates in fact appear in the plan for  
11 used fuel document which I have referred to previously,  
12 Exhibit 520.20.

13 Q. And is the revision of those two  
14 dates due to resorting or re-racking, or is that a  
15 decreased demand for electricity?

16 A. I'm not sure. It could be a  
17 combination of both. I really don't know what was the  
18 factor involved.

19 Q. But if I understand you, the first  
20 three dates on the table are--

21 A. Yes.

22 Q. --assuming that you can pack in as  
23 much as you can safely get in?

24 A. Yes.

25 Q. Mr. Johansen, I take it that you knew



1 when the stations were built and the layouts were  
2 finalized that you would not have enough storage  
3 capacity on site for the life of the reactor.

4 Were you assuming that the permanent  
5 repository would be available by the time that your  
6 fuel bays were full?

7 A. I can't agree with your first  
8 statement. I think you said we knew that we wouldn't  
9 have enough storage capacity on site.

10 Q. Yes.

11 A. No, we do believe we have enough  
12 capacity on site. It was always understood that the  
13 primary fuel bay within the plant would not take the  
14 plants to the end of their lives, so those primary fuel  
15 bays were only designed to hold I believe seven years  
16 for the earlier plants, Darlington might have a  
17 slightly greater capacity, I can't just recall, but it  
18 was never assumed that those primary bays would hold  
19 the fuel that would arise from the lifetime operation  
20 of the plant.

21 It was always intended that auxiliary or  
22 interim storage facilities would be required and that  
23 those additional storage facilities would be at the  
24 reactor sites.

25 Q. When you built --

1                   A. And that is what we have been doing,  
2     in fact, is building additional storage facilities at  
3     the reactor sites.

4                   Q. When you built the stations  
5     originally you built the secondary irradiated fuel bays  
6     at that time and when you -- first of all, is that  
7     correct--

8                   A. No.

9                   Q. --you built the secondary --

10                  A. Not originally. The additional  
11     facilities came along subsequent as required and that's  
12     the situation we are facing now. It is simply the need  
13     for additional storage capacity as we have provided  
14     previously at Pickering, for example.

15                  Q. Okay.

16                  A. So we build these facilities when we  
17     need them.

18                  Q. And when the facilities that we saw  
19     listed in the interrogatory are full, you intend to be  
20     dry storing the fuel and the dry storage modules that  
21     you have spoken of are being tested; is that correct?

22                  A. For Pickering, that's true, yes.

23                  Q. And for the other stations?

24                  A. For the other stations that's still a  
25     question. At Bruce we may continue with pool storage

1 or we may go to dry. It's still an open question and  
2 Darlington similarly.

3 Q. However you store the used fuel, it's  
4 clear from the numbers on the table, on the  
5 interrogatory that we looked at that you will be  
6 requiring a lot of additional storage between now and  
7 2025 when you project the permanent disposal facility  
8 to be available; right?

9 A. Yes, that's true.

10 Q. And you have testified --

11 A. But again I have to point out that  
12 that has been part of our plan all along and our  
13 assessment is that we have the storage capacity at the  
14 sites to continue accommodating these fuel quantities  
15 that we forecast from lifetime operation of the plants  
16 at the reactor sites.

17 Q. We will come back to this in a  
18 minute, but can you confirm for me now that when the  
19 reactors were built you were assuming that the  
20 permanent repository would be available by the year  
21 2000; is that right, in 1979, 1980?

22 A. Whether it was the year 2000 or some  
23 date beyond the year 2000 I can't recall just off the  
24 top of my head, but certainly the assumed date was some  
25 time prior to the current in-service target of 2025.

1                   Q. And you have testified I think that  
2 even with the current target of 2025 there's  
3 significant uncertainty about that date, a lot of that  
4 is out of your control. Do you recall that testimony?

5                   A. Oh yes, quite. But I also recall  
6 pointing out that while that may be an achievable date  
7 and is a conservative date in terms of the economic  
8 analysis that was done, we have the capacity to  
9 continue storing the fuel at our reactor sites, as I  
10 have said, such that there is no urgency to come up  
11 with a long-term solution by the year 2025.

12                   If the process has to take somewhat  
13 longer than that, well so be it, it's not going to  
14 cause a major problem for us.

15                   MR. KING: A. If I may just add  
16 something there. I was involved with the early design  
17 of Darlington in the mid-1970s and the Darlington  
18 design right now has two spent fuel bays on each end.  
19 If you look at all the major structures, the last  
20 building to the right and the last building to the left  
21 are each a spent fuel bay.

22                   The land just between that building and  
23 the lake is reserved, there's nothing there, and that  
24 land is reserved for future expansion of fuel bays that  
25 may be required in the future.

1                   And at that time, in the mid-1970s, the  
2                   land was reserved for that purpose with the intention  
3                   that the site -- the objective was that you had  
4                   capability on site to store all the fuel for the life  
5                   of a station and, hence, you were not dependent on the  
6                   existence of a disposal facility.

7                   Q.   Mr. Penn, the OM&A costs for the dry  
8                   storage or any additional storage facilities, whether  
9                   wet or dry to the year 2025 when the permanent  
10                  repository is assumed to be in place, are those costs  
11                  currently allocated to your future projections for OM&A  
12                  as well?

13                  MR. PENN:   A.   Yes, they are, as I  
14                  testified in my direct evidence.

15                  Q.   Is there an interrogatory or a  
16                  document where we can find the interim storage costs  
17                  broken out of the OM&A projections?

18                  A.   I don't recall such an interrogatory  
19                  but there may be amongst the very many that we have  
20                  answered.

21                  Q.   I don't recall seeing one.   I wonder  
22                  if I could ask you to undertake to check when you have  
23                  a chance whether there has been an answer and, if not,  
24                  provide us with a breakout of those operating costs.

25                  MR. JOHANSEN:   A.   Mr. Mondrow, I just



1 happened to turn up page 35 of your interrogatory  
2 materials and it doesn't exactly answer your question  
3 but I think it tends to confirm what Mr. Penn said.

4 Interim storage costs -- this is the  
5 second paragraph down on page 35.

6 Q. Yes.

7 A. Interim storage costs for used  
8 nuclear fuel in Ontario Hydro is part of the nuclear  
9 stations' operation costs, transportation disposal and  
10 future costs. So I guess what this is saying is that  
11 the people who have provided the transportation and  
12 future management and disposal costs have not provided  
13 a breakdown in costs for interim storage, and I don't  
14 personally recall seeing such a breakdown and there  
15 might be some effort involved in actually  
16 disaggregating the cost of that.

17 MR. PENN: A. I could also refer to page  
18 60 of Exhibit 519 which breaks out the partial OM&A  
19 costs, that I testified to, and in the direct OM&A it  
20 lists, the second bullet, radioactive waste storage.  
21 And currently the OM&A for our nuclear plant, if my  
22 memory serves me correctly, approaches a billion  
23 dollars a year and the vast majority of that money is  
24 related to the fixed costs of station, labour and  
25 materials, purchase services to operate the plants, and



1 the various research and development necessary to  
2 support the ongoing nuclear operations and satisfying  
3 our regulator.

4 So I can confirm it's there.

5 Q. Yes.

6 A. I'm not able to give you right now  
7 the exact amount of money except to note that direct  
8 OM&A amounts to about 18 to 19 per cent of the total  
9 levelized unit energy costs for the system.

10 Q. Perhaps, Mr. Penn, I could ask you to  
11 check if the interim storage costs as disaggregated are  
12 readily available and you can advise us if they are  
13 available.

14 Would that be appropriate?

15 MR. MONDROW: Perhaps we should have an  
16 undertaking number, Mr. Chairman.

17 THE CHAIRMAN: 532.

18 THE REGISTRAR: 532.15.

19 ---UNDERTAKING NO. 532.15: Ontario Hydro undertakes to  
20 check if the interim storage costs as  
21 disaggregated are readily available and  
22 to advise if they are available.

23 MR. MONDROW: Thank you.

24 Q. Mr. Johansen, your future 4 by 881  
25 proposal, as I understand it, includes pool storage for  
10 years' worth of fuel in its current costing; is that

1 correct?

2 MR. JOHANSEN. A. That's my general  
3 understanding.

4 Q. Could you turn please to page 26 of  
5 our interrogatory package.

6 A. Yes, I have that.

7 Q. This Interrogatory 9.14.10 has  
8 already been marked as Exhibit 520.28.

9 If you look on the next page, please, the  
10 first sentence of the response in reference to nuclear  
11 fuel disposal at the end of the first line, it says:

12 The concept and technologies are  
13 well established...

14 Mr. Johansen, what does that mean, to a  
15 have a well-established concept?

16 A. My view is that what this implies is  
17 that the conceptual design, the 12 years of research  
18 and development has resulted in a conceptual design for  
19 a disposal facility which I referred to in my direct  
20 evidence and that that conceptual design is based upon  
21 proven technology, technology that is here today.

22 In fact, that is one of the principles in  
23 the program, that disposal be based on a proven  
24 technology and not some theoretical technology that  
25 might be thought achievable at some point in the

1 future.

2 [10:40 a.m.]

3 I think that's what they mean when they  
4 say it's established.

5 Q. Mr. Johansen, when we were talking --  
6 when I was talking with Mr. Penn at the outset of my  
7 examination, we were looking, you will recall, at the  
8 CNA brief, and Mr. Penn, with respect to this disposal  
9 technology, said that the technology was well  
10 understood although obviously you couldn't go out and  
11 get it anywhere today.

12 So I take your comments to mean then that  
13 we should be reading this as the technologies being  
14 well understood rather than well established; is that  
15 fair?

16 A. Yes, I don't have any problem with  
17 that substitution of words.

18 Clearly it's not built, so if that's what  
19 you read into the word "established", that would be  
20 wrong.

21 But the technology is proven. We have  
22 been mining in hardrock for many, many years; we have  
23 proven that we can build complex facilities; we have  
24 proven that we can safely manage radioactive materials,  
25 and really those are the technologies that we would be

1       relying upon, that apart from the massive geosphere  
2       that would be separating the engineered vault  
3       underground in the Canadian Shield, according to the  
4       concept and the environment.

5                   Q.   And the storage tasks and burial  
6       technologies, they are not the same as the other  
7       technologies, we haven't been using those all yet,  
8       right?   No one has.

9                   A.   Well, the technologies are simply  
10      based upon durable metal container design.   There is  
11      nothing particularly complicated about it.

12                   The containers, I mean, there are several  
13      layers of engineered barriers and several more layers  
14      of natural barriers that would separate the used fuel  
15      from the environment, beginning with the solid nature  
16      of the fuel itself, a ceramic form of the fuel encased  
17      in a zirconium alloy sheath, as we have also discussed  
18      earlier, that in turn would be contained in a durable  
19      metal disposal container, right now the reference  
20      designed for that is titanium which is considered to be  
21      very corrosion resistant, and we have every confidence  
22      that a disposal container of that sort could be made to  
23      last for thousands of years, it depends on how thick  
24      you want to make the walls.

25                   Certainly, there is every confidence that

1 the containers can last for at least 500 years, which  
2 is really the only period of real concern, because  
3 after 500 years the hazard from the used fuel arranged  
4 in the underground vault as proposed would be no more  
5 than the hazards associated with a uranium ore body.

6 Now, in addition, those disposal  
7 containers would be surrounded by a clay-based buffer  
8 and backfill and sealing materials. And of course the  
9 whole thing, the whole engineered vault would be deep,  
10 500 to 1,000 metres underground in the geologic  
11 formation on the Canadian Shield somewhere that has  
12 been stable for over a billion, close to 2 billion  
13 years. And there would be that massive geosphere with  
14 its inherent physical and geochemical retardation  
15 properties, and then the biosphere itself which would  
16 present further retardation opportunities.

17 So, it's basically a very sound concept  
18 relying on fairly straightforward technology, materials  
19 that we have today that we have been working with for  
20 many years, and it would be a concept that you could  
21 think of as emulating nature. Nature has been  
22 confining uranium and other radioactive materials  
23 occurring naturally in the earth's crust for billions  
24 of years as well, and that really is what the concept  
25 is trying to emulate.



1 Q. Mr. Johansen, you have been through  
2 all that in fact in your direct evidence and I recall  
3 that.

4 A. Yes.

5 Q. I didn't want to interrupt you.

6 But just to be careful with our words,  
7 you also testified in your direct evidence that the  
8 technologies are currently being developed. Do you  
9 recall using those words?

10 A. I may have used the word technology  
11 in the sense of developing an effective and efficient  
12 conceptual design.

13 To be absolutely correct, I suppose I  
14 should have used the conceptual design is being  
15 developed.

16 We could argue about the word  
17 "technology", but fundamentally the technology that is  
18 going to be employed in the Canadian disposal  
19 repository, and as far as I know, every other geologic  
20 disposal repository around the world, the technology  
21 employed in geologic disposal, period, is pretty  
22 conventional.

23 Now, I don't thereby mean to suggest that  
24 there is no controversy about it, but fundamentally  
25 geologic disposal is a sound concept.

1 Q. And the soundness of this concept is  
2 precisely what the federal environmental assessment  
3 panel is going to evaluate in the next couple of years.

4 A. Certainly.

5 Q. You just mentioned a period of 500  
6 years being the period of real concern. Is it your  
7 evidence then that it is only for 500 years that this  
8 irradiated fuel has to be isolated from the biosphere  
9 and after that it doesn't matter what happens to it?

10 A. No, not at all.

11 Clearly, the long-lived radionuclides in  
12 the used fuel, under certain conditions could present  
13 some hazard if somehow those nuclides, the long-lived  
14 nuclides, such as plutonium, were to somehow get out of  
15 the repository and into the environment, and that's a  
16 big if, but if they were somehow to get out of  
17 repository after a long, long period of time, say, more  
18 than 1,000 years later, if the containers then begin to  
19 leak and ground water is present and all of the other  
20 conditions that would be necessary to carry some  
21 nuclides out of the containers up and into the  
22 biosphere and in turn to expose human beings, if those  
23 nuclides were somehow to be taken into the body, then  
24 because they are so long-lived, they could then cause  
25 some internal irradiation, and I guess I am cutting Dr.



1 Whillans' grass here, but it would be under that sort  
2 of rather improbable circumstance that there would be  
3 some hazard.

4 So the potential hazard is certainly  
5 there for a very long period of time--

6 Q. How long?

7 A. --and that's why we are planning to  
8 isolate these materials the way we are. So that there  
9 is very, very remote possibility that have occurring.

10 Q. How long is the potential hazard?  
11 You just said 1,000 years, is that Ontario Hydro's  
12 position, that it's 1,000 years that they have to be  
13 concerned with?

14 Q. Let's start from another point --

15 A. After about 300 years or so, I think  
16 I mentioned this in my direct evidence, the high level  
17 radionuclides or fission products would be pretty well  
18 gone, and beyond that we are basically only concerned  
19 about the longer lived nuclides, the actinides which I  
20 referred to.

21 Q. Yes, you referred to all of these,  
22 and we discussed plutonium which has a half life.

23 A. And they would be radioactive for  
24 thousands of years beyond that. But the question of  
25 actual hazard depends on the extent of exposure.

1 Q. Yes, I understand.

2 A. And that's the question. I mean,  
3 when you look at the overall effect of the several  
4 engineered and natural barriers, there is a very low  
5 probability, in my view, that the inherent toxicity of  
6 these long-lived radionuclides would cause a  
7 significant exposure to humans.

8 Q. Mr. Johansen, I am not asking about  
9 probability. I am asking for a number of years out  
10 into the future that Ontario Hydro feels the waste must  
11 be contained. You have said 500 and then you said  
12 1,000 and now you are saying thousands. Can you give  
13 me just a number of years that you want to be sure that  
14 the wastes are contained. Is 100,000 years fair, do  
15 you think?

16 A. The regulatory requirement is, this  
17 is the Atomic Energy Control Board regulatory  
18 requirement, R104, is that the probabilistic risk  
19 analysis which has to be submitted as part of the  
20 environmental impact statement, that has to show, on  
21 the basis of computer modelling, that the repository is  
22 safe for 10,000 years, and that's consistent with  
23 regulatory limits in the U.S. and elsewhere.

24 Q. So the regulatory requirements  
25 specifies that the facility has to be leak-tight and

1 safe from the elements for 10,000 years, it has to be  
2 perfectly contained for 10,000 years. That's your  
3 understanding of the requirement?

4 A. There is a probability associated  
5 with that, a risk probability basis associated with the  
6 10,000 years, and I can refer you to the specifics of  
7 that, if you would like.

8 Q. No, that is fine.

9 A. Ten thousand years is the key, is the  
10 period over which the PRA has to be carried. Beyond  
11 that, the Atomic Energy Control Board, and I believe  
12 other regulators in other jurisdictions, are satisfied  
13 with so-called reasoned argument, and I believe that  
14 that recognizes that beyond that sort of period of time  
15 it become rather meaningless to carry mathematical  
16 projections any further.

17 Q. But that doesn't mean there is no  
18 risk after that time. It just means that our  
19 mathematical projects can't cope with time that long;  
20 is that right?

21 A. Well, mathematical projections become  
22 questionable and the question of the human population  
23 and ecosystem of concern is also questionable.

24 The whole concept of risk beyond 10,000  
25 years in the judgment of the regulators is questionable

1 and therefore they are not requiring PRA to be carried  
2 any further into the future than 10,000 years.

3 [10:55 a.m.]

4 Q. So even on the AECB's R104 scale we  
5 are talking about thousands of human generations into  
6 the future that you want to be sure this stuff is  
7 contained; right?

8 A. Well, 10,000 years doesn't  
9 necessarily equate to thousands of generations, but  
10 it's a long time.

11 Q. If 20 years is a generation we are  
12 talking about 5,000 generations; is that right?

13 A. Yes, all right. I won't ...

14 Q. Do you know what Ontario looked like  
15 10,000 years ago?

16 A. Well, I mean, obviously not from  
17 first-hand observation, but I certainly have had  
18 occasion to review the scientific assessment of what  
19 this area of the world looked like 10,000 years ago and  
20 this is in connection with the aftermath of the last  
21 period of glaciation that I am talking about.

22 Q. The last period of glaciation was  
23 about 11,000 years ago in Ontario is that your  
24 understanding?

25 A. Well, there are different opinions,

1 but it's something like between 11 and -- I have seen  
2 14,000 years, but...

3 Q. It's safe to assume--

4 A. That's close enough.

5 Q. --that before that period Ontario  
6 didn't look much like it looks today; would you agree?

7 A. On the surface, yes, that's certainly  
8 true, from what I know. However, the whole point in  
9 using or proposing geologic disposal is to remove that  
10 variable as a prime factor and going 500 or 1,000  
11 metres underground you are reducing the potential for  
12 such evolutionary changes in the environment from the  
13 equation.

14 I think we have confidence that with a  
15 deep disposal concept as we are proposing that even if  
16 there were another glaciation period within the next 10  
17 or 15,000 years that the consequence of that would be  
18 acceptable.

19 Q. Is it accurate to say that within the  
20 last 10,000 years or so there has been considerable  
21 tectonic and seismic activity across Ontario? Have you  
22 studied those kind of activities dating that far back?

23 A. I recall Mr. King talking about that  
24 in earlier cross-examination.

25 Q. I recall that too, Mr. King said that



1 seismic activity has been monitored since about the  
2 1930s, I believe you said Mr. King, and before that you  
3 were talking about historical records.

4 Do you know how far back those historical  
5 records go? It's not 10,000 years, certainly.

6 MR. KING: A. The period I was referring  
7 to for the historical records was in the 300 or so  
8 years, but I believe - and perhaps, Mr. Johansen knows  
9 more than I about the stability of the plutonic  
10 formations that are being looked at - and that  
11 stability I think is considered seismic potential as  
12 well.

13 Q. Mr. King -- sorry, Mr. Johansen.

14 MR. JOHANSEN: A. Yes. The consensus of  
15 the geologists at the Geological Survey of Canada is  
16 that the plutonic rock formations on the Canadian  
17 Shield and these are the formations which are being  
18 proposed as the host rock, if you will, for the  
19 disposal concept, their consensus is that these  
20 plutonic rock formations have been in place for up to  
21 two billion years. And those formations during that  
22 period of time have not seen major folding or other  
23 upheaval and that there is every likelihood that they  
24 will remain stable for as long as we would be concerned  
25 about the radioactive materials placed in a repository



1 within these rock formations.

2 That was also the view of the Hare  
3 Commission which reported to the Department of Energy,  
4 Mines and Resources back in 1977 which got the whole  
5 Canadian repository program started in the first place.

6 Q. You said major upheavals. Would a  
7 non-major upheaval have a potential effect on a  
8 repository? You don't have to have a whole crust fold  
9 in order to break something apart. That's fair; isn't  
10 it?

11 A. That's right. Perhaps I chose my  
12 words a bit carelessly there. The Canadian Shield was  
13 chosen because of what was considered to be its  
14 relative stability compared to other geological  
15 formations within the country.

16 And plutonic rock formations within the  
17 Canadian Shield were chosen for a variety of reasons,  
18 some of them including the fact that they are, by their  
19 very nature, very stable and also at their core do not  
20 contain much if any known mineralization, which might  
21 attract exploration in future. So, that was considered  
22 to be a positive factor, as well, in terms of  
23 discouraging, or at least not attracting, future  
24 inadvertent penetration into the repository.

25 Q. Your confident then that those

1       plutons that you referred to 10,000 years from now will  
2       look the same and be the same as they are now. They  
3       won't move, they won't shift, they won't crack.

4               A. I am not saying they won't  
5       necessarily have cracks in them particularly near the  
6       surface, in fact they are fractured near the surface.  
7       However, I am confident based on the consensus of the  
8       very considerable geological and hydrogeological  
9       scientific expertise that's been brought to bear on the  
10      Canadian situation and similar situations elsewhere in  
11      the world. Yes, I am confident that they will remain  
12      in place, stable basically unchanged for millions of  
13      years.

14             MR. PENN: A. I would like to add one  
15      thing, that there's now been 12 years of extensive  
16      research and development and underground laboratories  
17      to explore these matters together with extensive  
18      international collaboration. And this, of course, is  
19      the subject of the forthcoming hearing with the FEARO  
20      to review all these matters and I know that there are  
21      volumes and volumes of scientific material on this  
22      subject.

23             Q. Could you turn to Exhibit 648,  
24      please.

25             Mr. Chairman, this is an exhibit that

1 IPPSO filed at the start of our cross-examination, it's  
2 an article from the publication and the title on the  
3 precis is State of the World Report 1992, article  
4 entitled Confronting Nuclear Waste.

5 Mr. Johansen are you familiar with this  
6 publication, State of the World Report?

7 MR. JOHANSEN: A. I have heard of the  
8 general publication State of the World. I can't say  
9 that I have religiously reviewed the reports as they  
10 have come out each year but I am generally aware of it.

11 Q. I have copied the forward to the  
12 report as well for your information. I would rather  
13 not take you through it. It's fair to say isn't it  
14 that this report is published in many countries in many  
15 languages?

16 A. Well, I think that is the trend. I  
17 don't believe it always was so. It has not been around  
18 that long, and on the other hand it's fair to say that  
19 it's circulation appears to be increasing.

20 Q. Could you turn to page 50 of the  
21 article itself, please. The article pages are numbered  
22 in the top corners, I think, left and right  
23 respectively.

24 A. Yes.

25 Q. Starting at the last sentence on that

1 page, it says:

2 Most of the existing irradiated fuel  
3 is stored in large pools of cooling water  
4 along side nuclear reactors. Originally  
5 designed to hold only a few years worth  
6 of waste, space constraints have led to  
7 packing the spent fuel closer together  
8 and the use of air cooled vessels  
9 including dry casks to hold older, cooler  
10 irradiated fuel.

11 So, it's fair, Mr. Johansen, to say that Ontario Hydro  
12 aren't the only ones who are now grappling with how to  
13 store fuel after their fuel bays are full. Perhaps  
14 grappling is not the word that you choose, but  
15 certainly considering what to do next?

16 A. Oh certainly. This is basically a  
17 global challenge and I might add that the ultimate  
18 solution is seen by virtually every nuclear country, if  
19 I may call them that, as the best way to go --

20 Q. Looking -- sorry.

21 A. And that the U.S. and Sweden and  
22 Switzerland have all completed disposal concept  
23 assessments and concluded that geologic disposal can be  
24 implemented safely.

25 Q. On page 51 of the article, please,

1 there's a table which gives volumes of accumulation of  
2 irradiated fuel from commercial nuclear plants, 1985,  
3 1990 and official projections to the year 2,000. And  
4 we see that Canada is listed second in that table in  
5 terms -- actually, second in terms of volume but for  
6 the other category, on which I assume is a footnote  
7 that will tell you what's included there. But Canada  
8 has got the second most major problem in terms of  
9 volume for storage of used fuel, that's an accurate  
10 ranking is it?

11 A. Well, the numbers are not precise. I  
12 am not sure where they would have got these numbers  
13 from. For example, if you look in the 1990 column the  
14 middle column or fourth column over from the left, or  
15 third column, rather. It indicates, for Canada, 17,700  
16 metric tonnes, and in my direct evidence, based on our  
17 own numbers Ontario Hydro has accumulated some 14,400.  
18 So, if the difference could be ascribed to the other  
19 two nuclear operators in the country, I suppose that  
20 number is reasonably accurate.

21 Q. It's about right that you are in that  
22 range of the charts seconds or third entry, would you  
23 agree with that?

24 A. Yes that doesn't surprise me at all.

25 Q. Great.



1                   A. However, I wouldn't characterize that  
2 situation as a major problem even though we may be in  
3 the top two or three in terms of tonnage, the volume is  
4 not large and is quite manageable.

5                   Q. Would you turn to page 53 of the  
6 article, please.

7                   A. 53, did you say?

8                   Q. 53.

9                   A. Thank you.

10                  Q. If you look at the column on the  
11 right under the heading, they call it, disposal. The  
12 last full paragraph, first sentence says:

13                   All countries using nuclear power are  
14 pursuing geologic burial as the solution  
15 to their waste... Which is what you have  
16 just testified to...yet by their own time  
17 lines, most programs have fallen way  
18 behind schedule.

19                  Is that your understanding, Mr. Johansen,  
20 of the worlds situation.

21                  A. Okay, I just found it, yes. Yet by  
22 their own time lines, way behind schedule. I suppose  
23 that is a way of saying that original target dates that  
24 the various countries had, including Canada, were  
25 somewhat optimistic. I would agree with that.



1                   However, I don't believe that should be  
2     interpreted as meaning that these countries are in some  
3     kind of dire straights with regards to safely managing  
4     the fuel, therefore. I don't think you can equate the  
5     fact that they haven't implemented disposal as early as  
6     they had originally targeted as meaning that management  
7     of used fuel or other radioactive materials is not  
8     safe.

9                   Q. Just bear with me for one minute, I  
10    am trying to track down a reference.

11                  A. In the meantime, perhaps I could just  
12    add a comment, that the whole process of deciding on  
13    the appropriate disposal technology for various  
14    countries and subsequently the question of selecting a  
15    site and carrying out detailed characterization of that  
16    or a number of sites, is a complex process involving  
17    many, many government regulatory, scientific and public  
18    interests that have to be taken into account.

19                  I believe it was the lack of appreciation  
20    of the importance of consultation from top to bottom  
21    that caused some of the earlier programs to fall behind  
22    schedule so to speak. But I believe by the same token  
23    that most countries now realize that that indeed has to  
24    be part of the process, that there has to be full  
25    consultation. And most programs, that I am aware of

1 now, are building that into their decision-making  
2 process. I think we are finally on a more realistic  
3 track.

4 Q. You could not confirm a few minutes  
5 ago that in 1980 you were planning for a 2000  
6 in-service date for the repository. I had a reference  
7 which I have just tried to find and I can't find it  
8 just this minute, so rather than spending time, I  
9 wonder if you could accept, subject to check, that  
10 sounds reasonable doesn't it, that in about 1980 you  
11 were planning on a 2000 in-service date; would that  
12 surprise you?

13 A. As late as 1980, I am not sure. I do  
14 recall though that in the mid-70s, when, for example, I  
15 was intimately involved in the environmental assessment  
16 of the Bruce "A" generating station and putting some  
17 thought to these sort of questions, the year 2,000  
18 seemed like a long ways off and everyone was in the  
19 habit of referring to the year 2,000 and beyond as a  
20 sufficiently remote date in the future.

21 I don't think that referring back to some  
22 target like that really means much at this point.

23 Q. You can't confirm that the in-service  
24 date for your cost estimates and your planning has  
25 moved to 2010, 2015 and now 2025 respectively?

1                   A. It has moved. I can't recall if  
2                   there were in fact those discrete moves but you might  
3                   be quite right. All I might just add to that is that  
4                   the earlier in-service dates are generally considered  
5                   to be conservative from an economic or a costing point  
6                   of view, but that's about all that really hangs on  
7                   that.

8                   Q. When you say conservative from a  
9                   costing point of view, what does that mean?

10                  A. Again, this is Mr. Penn's area of  
11                  expertise, but I think he would generally confirm that  
12                  the further out into the future that one defers a  
13                  commitment to any major capital project such as this,  
14                  the cheaper it's going to be.

15                  [11:15 a.m.]

16                  Q. That's right. So if you were to be  
17                  conservative you would pick an earlier date rather a  
18                  later date.

19                  A. That's what I am saying exactly. At  
20                  various planning points in the past, it was  
21                  conservative at that time to assume the year 2000, say,  
22                  the year 2010, and so on. It was not have been  
23                  conservative to have assumed 2030 or 50.

24                  Q. Can you confirm that the 2015 date  
25                  was used in ONCI?

1                   A. Yes. It was only recently, I think  
2 around 1989, in our update to the Ontario Energy Board,  
3 that we reconciled the year 2025 as a target date with  
4 the assumptions that AECL was making at that time.  
5 Perhaps Mr. Penn can confirm that.

6                   MR. PENN: A. Well, I was intimately  
7 involved in writing the ONCI document and presenting  
8 it. And we knew at the time we wrote it that the year  
9 2025 was practical and appropriate. But we were  
10 determined in the ONCI inquiry to make the cost data,  
11 which was being challenged as conservative as it was  
12 humanly possible and we deliberately chose 2015 for  
13 used fuel disposal for that purpose. Recognizing also  
14 that it may be possible with extreme effort to do it by  
15 that time.

16                  Q. Mr. Johansen, you have testified that  
17 the changes in your estimates for in-service date, one  
18 of the reasons for the changes is that there is less  
19 urgency and that you could now take the time to do it  
20 right.

21                  From those comments I would take it that  
22 with your conservative estimates, the earlier years,  
23 there wouldn't have been enough time to do it right you  
24 are now finding; is that correct?

25                  MR. JOHANSEN: A. I don't think that --

1 when I say do it right, I mean to implement the whole  
2 repository project with due consideration to the views  
3 of those who are potentially going to be affected by  
4 the project.

5 I believe the technology is well enough  
6 established. So when I said to do it right, I mean to  
7 do it right in a technological sense as well as a human  
8 decision-making sense.

9 Q. Can you confirm that the average  
10 transportation distance in your early estimates was  
11 1,600 kilometres and in your current estimate it is  
12 1,000 kilometres?

13 A. For a costing purposes you mean?

14 Q. Yes, that's one of the purposes.  
15 Yes, for costing purposes.

16 A. Because I would have to add that it  
17 has only been for costing purposes that we have made  
18 those sort of assumptions.

19 Q. Why do you add that caveat?

20 A. Well, for anything other than costing  
21 purposes we have not prejudged what the transportation  
22 distance would be, and the reason simply is that we  
23 have not prejudged where the site is going to be, but  
24 for costing purposes we obviously had to assume some  
25 distance for shipment purposes, but that's totally



1 without prejudice to the later question of where the  
2 repository might be located.

3 Q. You can confirm those dates though  
4 for costing estimates then?

5 A. For costing, yes.

6 Q. I'm sorry, those distances from 1,600  
7 kilometres to 1,000 kilometres?

8 A. Yes. Although I am not entirely  
9 certain what the rationale for the change would be.

10 Q. That was going to be my next question  
11 seeing as you don't know where the site is going to be  
12 as you have just said, I am not sure why you changed  
13 the distance. Does anyone else know?

14 MR. PENN: A. Well, the distance of  
15 1,000 kilometres has been assumed now to my knowledge  
16 for 10 to 15 years.

17 I vaguely recall 1,600 kilometres. If  
18 someone had asked me what it was, I would have guessed  
19 that it was not much more than 1,000 kilometres. But  
20 we certainly had 1,000 kilometres in the assumption for  
21 a very long time.

22 MR. JOHANSEN: A. There may be some  
23 confusion between units here. 1,000 miles equates to  
24 1,000 or 1,600 kilometres, and the other possible  
25 source of the --



1 Q. I can give you the source of this  
2 comment. That might clear it up rather than  
3 speculating.

4 If you turn to page 35 of our  
5 interrogatory package, this is the March 1989 paper,  
6 attached to that interrogatory, entitled: Used Nuclear  
7 Fuel Management Plan and Future Costs, page 35 of the  
8 package is page 2 of the report, and if you look in the  
9 first paragraph, it reads:

10 The reference used nuclear fuel  
11 management strategy and assumptions made  
12 for estimating costs were reviewed in  
13 1984.

14 Mr. Penn, that would have been seven  
15 years ago -- eight years ago I guess now.

16 And two changes are recommended;  
17 namely, the disposal facility in-service  
18 date be changed from the year 2000 to the  
19 year 2010, and B, the transportation  
20 distance to the disposal facility be  
21 changed from 1,600 kilometres to 1,000  
22 kilometres.

23 So I take a couple of things from that  
24 paragraph; first of all, the date of the change was  
25 1984, and, secondly, it's not a matter of confusing

1 miles and kilometres. Would you agree with that?

2 A. Yes, I see this. And now that I see  
3 this in context, I believe that what has happened here  
4 is the following: The 1,600 kilometre distance happens  
5 to be approximately the distance from the centroid of  
6 our existing nuclear reactor sites to the geographical  
7 centroid of what is referred to as the northern region  
8 on the Canadian Shield, this is a region that is  
9 identified as such within government administration.

10 A thousand kilometres roughly happens to  
11 be the distance from that same centroid of our existing  
12 reactor sites to what is referred to as the central  
13 region, and there is -- I think it is closer to 400  
14 kilometres or so from the centroid of our reactor sites  
15 to what we refer to as the southern region of the  
16 Canadian Shield.

17 I suppose the people who were preparing  
18 this document, which we are looking at now, determined  
19 that if we were really going to try to make this whole  
20 costing basis somewhat more realistic than to chose the  
21 centroid of the entire Canadian Shield study area, that  
22 was perhaps more reasonable. That's all I can think...  
23 That's all I know about it, actually.

24 Q. Of course the shorter distance  
25 reduces cost as well.

1 A. Yes, certainly that's true.

2 MR. MONDROW: Mr. Chairman, I have  
3 provided copies of an additional interrogatory to the  
4 Board and to Ontario Hydro this morning. We had  
5 inadvertently left this out of our package.

6 THE CHAIRMAN: Could we give it a number,  
7 please.

8 MR. MONDROW: Interrogatory No. is  
9 9.7.20.

10 THE REGISTRAR: .139.

11 MR. MONDROW: It is just a one page  
12 interrogatory. There are copies here on the table for  
13 those who would like.

14 ---EXHIBIT NO. 520.139: Interrogatory No. 9.7.20.

15 MR. MONDROW: Q. The response to that  
16 interrogatory tracks the changes in capital costs for  
17 the permanent disposal facility from the 1979 estimate  
18 to 1989 estimate, and gives both values in 1990  
19 dollars.

20 Mr. Penn, are these estimates present  
21 values to the date of the estimate?

22 MR. PENN: A. Well, I am not quite sure  
23 what you mean. What they are is costs in constant 1990  
24 dollars of the results of studies done in 1979 and  
25 1989.

1 Q. Are they dollars in the years spent  
2 or have we present valued to determine what you would  
3 have to set aside to date?

4 A. I just said they are constant  
5 dollars, if that's what you mean by present valued,  
6 yes.

7 Q. They are present valued.

8 A. They are constant dollars in 1990  
9 dollars. They are the cost of undertaking, in this  
10 case, capital activities expressed 1990 dollars.

11 They are not dollars of the year spent.  
12 As I testified, I think with OM&A, in dollars of the  
13 year spent we are talking about of the order of \$9  
14 billion.

15 Q. So then the change of in-service  
16 dates --

17 A. Whereas this is \$3.81 billion in 1990  
18 value dollars.

19 Q. So if the in-service date hadn't  
20 change from 2015, for example, to 2025, these spreads  
21 would be larger now than they are on this table; is  
22 that right?

23 A. The answer is yes. And in the  
24 interrogatory that updated the levelized unit energy  
25 cost for 4 by 881 megawatt stations, it gave those

1 values.

2 Q. Okay.

3 A. But since these activities are spread  
4 over such a long period of time, the impact of the  
5 change in date, in this case from the ONCI value of  
6 2015 to 2025, on lifetime levelized unit energy cost is  
7 extremely small.

8 DR. CONNELL: Unless someone persuades me  
9 otherwise, I am going to assume that these are not  
10 present values. There seems to be no provision for the  
11 time value of money here. There is simply an allowance  
12 for the impact of inflation.

13 You can express a 2015 expenditure in  
14 1990 dollars, it might be, let us say, a billion  
15 dollars, and that's quite a valid way to express it,  
16 but if you treat it as a present value then you apply  
17 whatever discount rate is appropriate, and it would be  
18 a much smaller number expressed as a present value.  
19 But I think this is the former, unless there is some  
20 information that...

21 MR. PENN: Well, Dr. Connell, I  
22 understand what you are saying and I am afraid I cannot  
23 confirm that these are present value which would  
24 involve assuming discount factors and discounting back  
25 to present dollars.



1 DR. CONNELL: I think we are in  
2 agreement.

3 MR. PENN: I believe what they are is  
4 they are based upon mainly a design produced by Atomic  
5 Energy of Canada Limited, which Ontario Hydro has  
6 reviewed in considerable detail, and on the costing of  
7 that design in today's dollars. And secondly, they  
8 include, as you can see, a fairly recent allowance for  
9 post concept activities which were not previously  
10 included in the cost estimates in 1979.

11 MR. MONDROW: Q. Mr. Penn, based on Dr.  
12 Connell's point and your response then, I will assume  
13 that these are not present valued in the sense that Dr.  
14 Connell used the term, and I would appreciate that if  
15 you determine otherwise that you would advise us.

16 I would like to move on actually to a  
17 point that you just raised and that is in the 1979  
18 estimate, post concept activities weren't included, and  
19 in the new estimate they are included.

20 Post concept activities, Mr. Johansen, I  
21 understand to be getting from approval of the concept  
22 to actually starting to construct the concept; is that  
23 right?

24 MR. JOHANSEN: A. Yes. And they would  
25 include such things as the cost of site screening and



1 selection and detailed characterization.

2 Q. Your 1979 estimates didn't include  
3 anything for that. Why is that?

4 A. I can't say why not. I suppose the  
5 practical reason is that the cost estimates weren't  
6 then available and perhaps under the pressure to  
7 provide information to the OEB, it was put in and  
8 qualified as an incomplete estimate. Those estimates  
9 of so-called post concept activities are just now being  
10 developed.

11 Q. And those costs we can see under the  
12 right land column are a significant part of the total,  
13 over a third, right? If you look under the new cost  
14 column, you see 1158 1990 million dollars for post  
15 concept activities out of a total of 3181. That's over  
16 a third.

17 A. Yes. The way they are presented here  
18 at least they look like a significant fraction, but  
19 subject to the uncertainty about present value, I guess  
20 I really can't say very much about...

21 MR. MONDROW: Mr. Chairman, we could take  
22 a break now if it's appropriate.

23 THE CHAIRMAN: Okay, we will break for 15  
24 minutes.

25 THE REGISTRAR: Please come to order.

1 This hearing will recess for 15 minutes.

2 ---Recess at 11:30 a.m.

3 ---On resuming at 11:50 a.m.

4 THE REGISTRAR: Please come to order.

5 This hearing is again in session. Be seated, please.

6 THE CHAIRMAN: Mr. Mondrow.

7 MR. MONDROW: Thank you, Mr. Chairman.

8 Q. Mr. Johansen, I just have one more  
9 question right now about this time span. You  
10 testified, under questioning from Mr. Poch, that  
11 plutonium has a 24,000 year half life.

12 MR. JOHANSEN: A. Yes.

13 Q. I understand that to mean that after  
14 24,000 years half the plutonium is still around. Would  
15 that remaining half be dangerous if it reached out of  
16 the containment?

17 A. It would if it were somehow taken  
18 into the body. As we have indicated in earlier  
19 testimony, I believe Dr. Whillans has discussed this,  
20 it's a soft irradiator but if it were somehow inhaled  
21 into the lungs it could then have some toxic effect.

22 But I have to stress that while this is  
23 not -- it's an area that is ignored; it is on the other  
24 hand not a very likely scenario in the context of deep  
25 geologic disposal.

1 I might also comment from my general  
2 knowledge that ingestion such as in the form of  
3 drinking water or solid food is considered to have a  
4 much less toxic effect than inhalation into the lungs,  
5 but perhaps Dr. Whillans could confirm or add a comment  
6 to that.

7 Q. Yes, I'm happy to hear your comments,  
8 Dr. Whillans. My question is basically that at least  
9 in the case of plutonium we should be looking at --  
10 it's fair to look at 24,000 years, at least, as the  
11 time after which we needn't be as concerned with  
12 hazard, and we had talked about 10,000 years earlier,  
13 that's the point of my question.

14 Would you agree that in that one example,  
15 plutonium, the time frame at least is 24,000 years and  
16 probably more since that's only a half life?

17 A. Well, if plutonium were freely  
18 available, let's say, in the form of particulate or  
19 dust, yes, I would agree we would have to take  
20 extraordinary precautions, but the fact is it's bound  
21 up in the ceramic fuel and is contained within the fuel  
22 sheath and --

23 Q. Certainly as long as it sits in the  
24 repository it's not a danger, exactly.

25 A. Yes.

1 Q. If it gets out of the repository, if  
2 it leaches out it could be a danger?

3 A. Yes.

4 Q. Fine, that was my point.

5 A. And if it did get into the lungs.

6 Q. Okay.

7 DR. WHILLANS: A. Perhaps I could add a  
8 comment. You certainly won't get any argument from me  
9 that these are potentially toxic to human health, these  
10 radioactive materials, but there's nothing magic about  
11 plutonium-239 which is the one which has the 24,000  
12 year half life.

13 I think the point I tried to make in  
14 discussing this, I think Mr. Poch, was that the  
15 toxicity doesn't depend just on the half life, it  
16 depends on the yield and the availability.

17 For instance, plutonium decays to uranium  
18 235 which has a 800 million year half life, but that's  
19 found naturally in uranium ore, anyway.

20 I think we have to take all these things  
21 into account and look at the kind of calculations that  
22 have gone into the disposal concept before we decide  
23 whether or not it's acceptably safe.

24 Q. Okay. We were looking at  
25 Interrogatory 9.7.20 before the break. We had just

1 looked at the inclusion of post-concept activities in  
2 the new estimate and not the old estimate.

3 Assuming that this is not a present  
4 value, as Mr. Penn has said he'll check, otherwise we  
5 can assume that it's not a present value, if this  
6 column on the right were present valued then the  
7 post-concept activities segment of the cost would be  
8 proportionately greater than one third of the total; is  
9 that right, because you will be incurring those  
10 expenses once the concept is approved up to the time of  
11 construction, whereas the other expenses are  
12 post-construction expenses.

13 So we had agreed that the post-concept  
14 activities segment is about a third the way it's stated  
15 on this table and you had raised some concern about the  
16 present value situation, whether it was or wasn't.  
17 Assuming it's not, if this were expressed as a present  
18 value we get more than a third; is that fair?

19 MR. JOHANSEN: A. You are asking me?

20 Q. Yes.

21 A. Well, I guess the first comment I  
22 would make is that I'm not sure just how much detailed  
23 cost estimating effort has gone into generating this  
24 particular number.

25 I happen to know that a more detailed



1 estimate is being prepared right now. So this estimate  
2 may in fact be a pretty preliminary, conservative  
3 estimate for purposes of the rate setting submission.

4 Q. I'm just trying --

5 A. Secondly, as to what the impact of  
6 present value on the relativity between post-concept  
7 activities and overall project cost, I'm really not  
8 sure. That's not my area of expertise.

9 Q. I'm just following up on a comment  
10 that you made. You agreed that this was about a third  
11 of the total, the post-concept activities?

12 A. Sure.

13 Q. And you made a comment - and I'm  
14 sorry, I don't remember your precise words - you  
15 weren't sure about the present value situation that we  
16 have just been talking about.

17 MR. PENN: A. Maybe I can answer this  
18 Mr. Mondrow. I would like to confirm, first of all,  
19 that on response to Interrogatory 9.7.20 that these two  
20 sets of costs are in 1990 constant dollars and are not  
21 present value dollars.

22 Q. Okay.

23 A. Secondly, I would like to comment  
24 that in your package of material entitled:  
25 Interrogatories brought forward by IPPSO, that on your



1 page 46 it defines what is meant by post-concept  
2 activities following the Environmental Assessment  
3 Review Panel's review and FEARO hearing on this subject  
4 and clearly since the timing of when that will be  
5 completed and the timing therefore of when this  
6 post-concept activities will occur doesn't lend itself  
7 to net present value calculations at this time.

8 Q. Can you show me where it explains  
9 where post-concept activities are?

10 A. It explains it on your page 46--

11 Q. Yes.

12 A. --of your interrogatory package.

13 Q. Which is at the end --

14 A. 5.1 and I will read it, starting with  
15 the third sentence:

16 It is clear that a reference plan  
17 for the management of used fuel must take  
18 into account the concept assessment phase  
19 which is expected to last at least until  
20 1995.

21 What we are talking about there is the  
22 public hearing by FEARO into the concept technology.

23 After this phase, and irrespective of  
24 the outcome of the concept assessment,  
25 further optimization of the disposal

1 concept will be needed before its  
2 implementation. In particular, there  
3 would be a need to undertake activities  
4 for the purpose of optimizing the  
5 disposal facility layouts currently being  
6 proposed for the concept assessment. It  
7 will also be necessary to define detailed  
8 engineering plans with research and  
9 development support as required.  
10 Then it goes on to say, skipping the next  
11 sentence:

12 A review of these activities shows  
13 that the efforts needed in the  
14 characterization, screening and  
15 evaluation and selection of a site for a  
16 disposal facility will require  
17 substantial commitments of time and  
18 resources.

19 Q. Yes.

20 A. Et cetera. In other words, a number  
21 of sites will be looked at based upon a very large  
22 screening of the options of the pluton rock available.

23 Q. Yes.

24 A. And these sites will be fully  
25 characterized and then there would be another

1 environmental assessment hearing before, of course, the  
2 purchase if necessary of the land or the acquisition of  
3 the land on which the facility would be finally built.

4 Q. Yes. I'm sorry, Mr. Penn, I  
5 understand all that. I'm not sure what point you are  
6 responding to now.

7 A. I'm trying to describe to you what  
8 the post-concept phase activities are.

9 Q. And I had characterized those as  
10 basically getting from post-concept to construction.  
11 So you would agree that that's an accurate  
12 characterization of the details you just read;  
13 right?

14 A. Yes, and I'm saying that they are  
15 substantial.

16 Q. Yes.

17 A. These activities.

18 Q. Fair.

19 A. The other thing I wanted to note was  
20 that in my direct evidence I updated this figure of  
21 3181 to 1992 dollars and quoted it as \$3.45 billion in  
22 1992 dollars.

23 Q. Still on the interrogatory then,  
24 9.7.20 if we look under the heading repository related  
25 costs, the second sentence:

1                   The new costs are based on detailed  
2                   engineering carried out by Atomic Energy  
3                   of Canada Limited.

4                   And, Mr. Penn, you have just pointed us  
5                   to a description that talks about some detailed  
6                   engineering yet to come. So, is it fair to say that  
7                   even the current state of engineering is still somewhat  
8                   preliminary?

9                   A. The engineering of the technology is  
10                  described, what I'm talking about is the detailed  
11                  engineering that would be site specific, to actually go  
12                  about building the facility.

13                  Q. Right, which is where the capital  
14                  costs for building the facility would come from, that  
15                  site-specific detailed engineering; right?

16                  A. The site-specific detailed  
17                  engineering comes under the post-concept activities  
18                  number.

19                  Q. Right. So when it says the new costs  
20                  are based on detailed engineering, you are telling me  
21                  that that means detailed engineering of the  
22                  technologies and not necessarily the detailed  
23                  engineering of the site?

24                  A. You are quite right.

25                  Q. So, it's fair to say that the

1 estimates as updated by you in your direct evidence is  
2 not based on the detailed engineering on the site yet,  
3 you don't have that engineering yet?

4 A. No, and it wasn't pretending to do  
5 so.

6 Q. Certainly not. I'm just clarifying  
7 exactly what it is that you intended.

8 A. The other thing we should be clear  
9 about is the figure that I gave in my direct evidence  
10 was Ontario Hydro's costs for a repository that would  
11 hold 5 million bundles.

12 As I understand it, Atomic Energy of  
13 Canada is sizing the facility for a lot more than that,  
14 nearly double it because of the need for a national  
15 repository.

16 Q. The post-concept activity phase is  
17 about 15 years worth of work; isn't that right?

18 A. I don't think it's quite 15 years,  
19 but it's certainly more than 10.

20 Q. And much of that work as you pointed  
21 out is going to be the detailed engineering of the  
22 site; right?

23 A. No. Most of the costs I think - and  
24 maybe Mr. Johansen can help me on this - but I believe  
25 most of the costs will be in the detailed

1       characterization of the various pluton granitic  
2       formations that are chosen as alternative options to be  
3       presented to the environmental assessment hearing.

4               In other words, you must have a detailed  
5       characterization of the rock in order to be able to  
6       show that it's practical and appropriate to choose that  
7       site or any one of the alternative sites that would be  
8       considered.

9               Q.   Well, two of the activities that you  
10      read out in that paragraph from the Ontario Hydro  
11      report talked about optimizing the disposal facility  
12      layouts, as you have pointed out, and the necessity of  
13      defining detailed engineering plans.  So there's still  
14      quite a bit of that work to do, obviously?

15              A.   I was just commenting -- I was saying  
16      that a large amount of the costs will be associated  
17      with drilling through this rock to know exactly where  
18      to put the main shaft and the underground facilities in  
19      that rock.

20              Q.   That's a post-concept activity cost  
21      that I drew your attention to?

22              A.   Yes.  And I wouldn't describe that as  
23      design.

24              Q.   Okay, that's fair.  But the design  
25      for the repository system is still fairly preliminary,



1 the detailed site-specific design; in fact, it hasn't  
2 been started yet because you don't know where the site  
3 is?

4 A. The design of the concept technology  
5 is very extensive.

6 Q. Yes. I'm talking about the specific  
7 site, the capital cost estimates for the specific  
8 repository?

9 A. Well, what we are talking about,  
10 Mr. --

11 Q. Excuse me, let me finish my question.

12 A. I thought you had asked the question.

13 Q. Well, so did I but I guess I didn't  
14 communicate it probably. Capital cost estimates for  
15 the repository facility are fairly preliminary because  
16 we don't have detailed engineering of the actual  
17 facility to base them on; is that fair?

18 A. No, it isn't.

19 Q. Okay. Could you explain, please?

20 A. The detailed engineering of the site  
21 merely is a matter of where would the roads go, where  
22 would the services be put into the site, where would  
23 the surface buildings go relative to the main shaft,  
24 what would be the nature of the layout of the surface  
25 facilities in order to perform the construction.

1                   That is called detailed engineering, but  
2                   it is really the nitty-gritty way of how you go about  
3                   constructing it.

4                   The design of the technology is the  
5                   subject of numerous volumes of material that Atomic  
6                   Energy of Canada has or is preparing. So I can't agree  
7                   with you on that.

8                   Q. So you are telling me that the costs  
9                   for building the repository are based on fairly  
10                  detailed understanding, they are a pretty good  
11                  estimate?

12                  A. There is extensive information on  
13                  which these engineering estimates have been made and,  
14                  as I said earlier this morning, Ontario Hydro has spent  
15                  considerable time reviewing them.

16                  Q. If you could turn back to --

17                  MR. JOHANSEN: A. Mr. Mondrow, perhaps I  
18                  could just add a quick comment. In general, the  
19                  disposal concept design, the conceptual design is not  
20                  considered to be optimized.

21                  The concept employs technology which is  
22                  proven and is considered to be effective, however, the  
23                  cost estimates are based on a combination of technology  
24                  which renders that cost estimate somewhat conservative.

25                  I believe what Mr. Penn said and what I

1 would like to say is that there is considered to be  
2 considerable opportunities still for, in fact, reducing  
3 cost on the basis of an optimized design and that is  
4 part of what the post-concept stage would do.

5 Q. Could you turn to page 29 of the  
6 interrogatory package. We are still on the same  
7 interrogatory, Mr. Penn, that you had just taken us to,  
8 this is 9.7.19, although these first two sheets are not  
9 part of the paper.

10 But we are given an updated table for the  
11 used fuel disposal capital costs and we see a  
12 contingency of 440 million 1990 dollars. That's  
13 roughly 30 per cent; is that correct, Mr. Penn?

14 THE CHAIRMAN: Sorry, where are we? What  
15 page?

16 MR. MONDROW: We are on page 29, sir, of  
17 IPPSO's interrogatory package and we are looking at a  
18 table of updated costs as of the date of the  
19 interrogatory for the used fuel disposal capital costs,  
20 and there's a contingency of 440 million 1990 dollars.  
21 I'm just asking Mr. Penn to confirm that's roughly 20  
22 per cent. It's actually somewhat less but I assume --  
23 sorry, 30 per cent. It's actually 28 point something,  
24 but I assume that's a function of rounding, it should  
25 be about 30 per cent?

1 DR. WHILLANS: A. Excuse me, 30 per cent  
2 of what figure?

3 THE CHAIRMAN: What figure?

4 MR. MONDROW: Q. Well, there's no figure  
5 here but it's 30 per cent I believe of the total  
6 repository system capital costs which is -- sorry,  
7 there is a figure, it's 1972.

8 DR. WHILLANS: A. I think that would be  
9 22 per cent.

10 MR. PENN: A. I'm just trying to work it  
11 out.

12 Q. It may be that I've made an error.

13 A. The 3.181 billion is the sum of the  
14 post-concept activities, the transportation system and  
15 the repository system, so the contingency is related to  
16 the repository system and it would be 440 million  
17 divided by 1972.

18 Q. Which is, as you said, Dr.  
19 Whillans --

20 A. Which is 22 per cent.

21 Q. About 22 per cent?

22 A. Yes.

23 Q. Mr. Penn, for the CANDU 3 and the  
24 CANDU 9 which you have testified have 85 per cent of  
25 their engineering completed you used a 30 per cent

1 contingency. Why are we only using 22 for a repository  
2 which seems to be, according to your testimony, in  
3 about the same state of completion?

4 A. Well, for the reasons that Mr.  
5 Johansen pointed out earlier, this repository concept  
6 and design employs currently known technology, it uses  
7 hardrock drilling for which Canadian mining industry is  
8 well-known in the world to be very knowledgeable, so  
9 it's not a new technology to drill through this rock.

10 The containers that have been designed  
11 and tested and are made of titanium with hydrostatic  
12 pressure buffers between the outer layer and encased in  
13 bentonite clay which, by the way, occurs readily in  
14 nature, and deposits of uranium in the Alberta/  
15 Saskatchewan area surrounded by bentonite has shown  
16 that the uranium hasn't moved in hundreds of centuries.  
17 So that's why we are confident that that is a very  
18 effective buffer.

19 [12:15 p.m.]

20 And of course, the rest of the technology  
21 is backfilling with sand and eventually encasing and  
22 decommissioning the facility, if you like, by  
23 backfilling with concrete.

24 So we are not talking about uncertainties  
25 in technology.



1 Q. So then with CANDU 9 and CANDU 3 you  
2 are talking about more uncertainties in technology;  
3 right?

4 A. Well, for a start off, Mr. Mondrow, I  
5 only commented that CANDU 3 was about 80 or 85 per cent  
6 design. I gave in my direct evidence that CANDU 9  
7 design was only just starting.

8 Q. You used 30 per cent for each of  
9 CANDU 3 and CANDU 9.

10 A. No, I used 25 per cent for CANDU 3,  
11 30 per cent for CANDU 9.

12 Q. Okay. So CANDU 3, just to be clear  
13 here, you said, I think, CANDU 3 is about 85 per cent  
14 pre-engineered, and you are telling me that CANDU 9 is  
15 pretty preliminary, so the difference in the  
16 contingency factor between the two that Ontario Hydro  
17 feels is appropriate is 5 per cent.

18 A. That was my judgment, yes. But I am  
19 trying to point out to you that the nature of building  
20 this repository using technology known today is a  
21 different matter than from building a power station.

22 Q. Okay.

23 A. Quite frankly, I think 20 to 25 per  
24 cent contingency which is what we have just shown this  
25 is, the 22.3 per cent, is in my judgment reasonable.

1 Q. Could you turn to page 129 of our  
2 interrogatory package, please. This is Interrogatory  
3 9.7.24, which, Mr. Lucas, needs a new number.

4 THE REGISTRAR: .140.

5 ---EXHIBIT NO. 520.140: Interrogatory No. 9.7.24.

6 MR. MONDROW: Thank you.

7 Q. If we look on the next page, page 130  
8 on the package, this a similar table to that that we  
9 saw for capital costs, this time for operating costs.  
10 If we look at the table, the costs for the  
11 transportation component of the operating costs for the  
12 new estimate as opposed to the old estimate is about a  
13 quarter, and in the following text we are given reasons  
14 for that.

15 I will just take you to that reference.  
16 I will just read the following paragraph:

17 With regard to transportation in the  
18 1979 studies, higher freight costs were  
19 assumed, due to the absence of the  
20 detailed knowledge of the operating  
21 parameters, payloads, distance, et  
22 cetera. Payloads were smaller and a  
23 larger number of used fuel bundles were  
24 assumed.

25 Just to a pause there for a second, we

1 see 5.54 million bundles in the early estimate instead  
2 of 4.63 in the a new analysis.

3 Mr. Penn, in your direct evidence I  
4 believe you stated 5 million. So is 5 million the  
5 current number?

6 MR. PENN: A. That's my understanding,  
7 yes. And that includes allowance for the equivalent of  
8 fuel discharge from a future 4 by 881 megawatt station.  
9 So I am afraid I can't help on these more precise  
10 numbers of 5.54 million and 4.63 million, unless Mr.  
11 Johansen can help me a bit more.

12 MR. JOHANSEN: A. I believe that when we  
13 talk about 5 million currently, that is a rounded  
14 number. The more precise number is something like 4.6.

15 If you look at the information that I  
16 provided in direct, the projection from our existing  
17 stations is about 3.8 million bundles, lifetime, and  
18 if, as Mr. Penn indicated, you add the fuel arising  
19 from another Darlington-sized plant, which is what was  
20 assumed, we would adjust under a million to that, and I  
21 believe that would add up to the 4.6 indicated here,  
22 and rounding it off is then the 5 million that we  
23 currently talk about.

24 Q. So a less rounded number is for 4.6  
25 million is your understanding of the current --

1                   A. That is what I would take from this,  
2       yes.

3                   Q. And that would include the fuel in  
4       the reactors at shut down; is that right?

5                   A. That would be total fuel arising from  
6       our existing plants, plus one additional Darlington.

7                   Q. Okay. If we look back to the  
8       paragraph I was reading from then and continuing on, it  
9       says:

10                   The 1989 costs are based on a more  
11                   detailed understanding and optimization  
12                   of the system requirements and 1,000  
13                   kilometre distance instead of 1,600  
14                   kilometres. The newer assumptions  
15                   significantly reduce the anticipated  
16                   system operating costs.

17                   So the distance reduction has had a  
18       significant impact in reducing the operating cost  
19       estimates. You would agree with that?

20                   A. Yes, I would agree with that.

21                   Q. If we look at the table again, if we  
22       look at the repository part of the operating costs,  
23       they have, in fact, gone up about 50 per cent. But if  
24       we look at the transportation part of the operating  
25       costs, they have come down, and then if we look at the

1 total, the overall decrease is about 17 per cent by my  
2 calculations.

3 You don't have to confirm the precise  
4 percentages, but that looks right to you?

5 A. Well, I have no reason to question  
6 these numbers. They are produced by the people at  
7 Ontario Hydro that are responsible for these matters,  
8 and I certainly wouldn't question their numbers.

9 Q. Mr. Johansen, can you confirm that  
10 other countries have had a very difficult time with  
11 public opposition to any site screening attempts for  
12 locating a fuel repository?

13 A. Yes, I would agree that there have  
14 been difficulties, but there have been successes as  
15 well.

16 Q. Can you recall any of those  
17 successes?

18 A. Well, in Sweden for example, they  
19 currently have underground repositories for low level  
20 wastes, as I think you, in fact, mentioned the other  
21 day. And there is, I might at, an underground,  
22 although it's a shallow underground storage facility as  
23 well for used fuel. And perhaps this is what Mr. Penn  
24 was alluding to the other day in that same discussion.

25 Q. For any permanent used repositories,



1 any successes so far?

2 A. Well, there isn't one developed, so  
3 one can't really say that there have been ultimate  
4 successes.

5 It's a controversial subject. There is  
6 no getting away from the fact the public are concerned  
7 about any hazardous material being put into some  
8 long-term facility.

9 It's a subject of general concern, that  
10 is the challenge, I guess you could say, that we  
11 somehow need to raise the comfort level of not just the  
12 decision-makers, the direct decision-makers, but also  
13 those who vote and who are potentially affected by  
14 them.

15 Q. It's a real public relations issue;  
16 right?

17 A. Well, I don't wish to belittle it by  
18 saying that it's a public relations issue. But public  
19 relations is going to play an important part in the  
20 ultimate decision-making process. There is no doubt  
21 about that.

22 I think I mentioned earlier that in my  
23 view it has perhaps been the underestimate or -- maybe  
24 that's the best way to put it, an underestimate on the  
25 part of various nuclear operators around the world to

1 take into account the concerns of the public and  
2 political and regulatory authorities from the national  
3 level right down to the municipal level that has  
4 accounted for the spotty record so far.

5 But I also I believe that there is now  
6 finally a general recognition that there needs to be a  
7 reconciliation or an integration of all of the concerns  
8 of all parties from national down to municipal levels  
9 before you can really hope to implement a facility of  
10 this sort. And that's not unique to the field of  
11 radioactive materials management, I might add that.  
12 That is a realization, I think, that has developed in  
13 the field of developing and siting management  
14 facilities for any hazardous material, industrial  
15 activities.

16 Q. Would you say that the public is a  
17 little more nervous about radioactive wastes than other  
18 wastes?

19 A. I would say that there are some  
20 people who have a special concern for anything that is  
21 radioactive. But I would say that if one were to  
22 take -- in fact, my recollection of public opinion  
23 surveys conducted by national polling services in this  
24 country, indicate that nuclear waste management is not  
25 the top concern at all, that there are other issues,

1 environmental issues, that concern them more.

2                   However, it is a significant concern, but  
3 it doesn't appear to be an overriding one.

4                   Q. Overriding. It hasn't gotten in the  
5 way of siting facilities around the world?

6                   A. No--

7                   Q. Permanent disposal facilities?

8                   A. --I didn't say that.

9                   I said that of the various environmental  
10 and energy related issues that concern people, nuclear  
11 waste management or long-term disposal of nuclear  
12 materials is not the No. 1 issue, in this country at  
13 least.

14                  Q. Okay. Can we look at Exhibit 648,  
15 please. This is the Worldwatch paper. Turn to page  
16 58, please. Under the heading the Politics of Nuclear  
17 Waste, the author discusses the U.S., and if we look at  
18 the right most column, the last sentence in the first  
19 partial paragraph on that column, it says:

20                   The result has been public opposition  
21 to nearly any siting attempt to develop  
22 radioactive waste facilities.

23                  A. I'm sorry, I didn't quite catch up  
24 with you.

25                  Q. We were on the right column.

1 A. Right column, on page 58, yes.

2 Q. On page 58, and just before the  
3 second paragraph is probably a clearer way to put it,  
4 the last sentence of the previous paragraph.

5 A. Yes, okay.

6 Q. The result has been public opposition  
7 to nearly any attempt to develop  
8 radioactive waste facilities.

9 Is that true, Mr. Johansen, in the U.S.?

10 A. This is with regards to the U.S.?

11 Well, I can't say whether public  
12 opposition has been a major delaying factor in every  
13 situation. The U.S. is a very different situation  
14 compared to the Canadian situation in that there are  
15 many more nuclear operators and many more parts of the  
16 country and therefore involving many more jurisdictions  
17 than is the case in this country. And I am not  
18 intimately familiar with all the situations, but I  
19 would dare say that there could not have been serious  
20 public opposition in every case or the industry simply  
21 wouldn't have been viable to the extent that it is.

22 However --

23 Q. We are talking just about the  
24 sighting of the burial facility here. I put my  
25 question to in that context.

1                   A. This is the part I haven't really  
2 captured here. If you are putting just the simple  
3 question to me pertaining to the repository program  
4 which is going on now--

5                   Q. Yes.

6                   A. --certainly there has been concern  
7 expressed by the State of Nevada, but I also am aware  
8 that the U.S. Department of Energy is now able to  
9 proceed with characterization of the site which they  
10 are initially looking at, the Yucca Mountain site. So  
11 there must be some degree of support that allows that  
12 process to go on.

13                  Q. We talked about Yucca Mountain. As a  
14 matter of fact, Mr. Penn mentioned it on Thursday, I  
15 believe. Mr. Penn said that he thought they might even  
16 have a used fuel disposal facility before we do. And  
17 Yucca Mountain is in Nevada, as you said.

18                  Is it true that Nevada has passed a  
19 statute prohibiting the disposal of irradiated fuel?

20                  A. Prohibiting the disposal of used  
21 fuel?

22                  Q. Yes, in the state.

23                  A. I don't know the details of that. It  
24 doesn't jibe with my understanding as of a month ago as  
25 to what is actually happening in terms of the site



1       characterization program there.

2                   Q.   Are you aware that there has been  
3       quite a battle between the state government and the  
4       federal government?

5                   A.   Yes.

6                   Q.   Nevada really doesn't want the stuff  
7       to go --

8                   A.   Certainly there has been consultation  
9       and perhaps it's even fair to say some dispute between  
10      those government levels, but there is a resolution  
11      process involved and the site characterization program  
12      seems to be proceeding.   So that's really what I  
13      observe and I can't really comment on the details of  
14      the process that's going on between the federal  
15      Department of Energy and the State of Nevada.

16                  Q.   Can you turn to page 59 of the  
17      article, please.   Looking at the last sentence before  
18      the bold part of the text in the right column, it says:

19                       Faced with a long list of technical  
20                       difficulties and firm political  
21                       opposition, Yucca Mountain has a very  
22                       long way to go before becoming the  
23                       country's burial site for high level  
24                       waste.

25                  I take it from your comments, Mr.

1       Johansen, you wouldn't adopt that statement?

2                   A. Well, I couldn't accept it as a  
3       general statement. Certainly the characterization of  
4       the Yucca Mountain site is not completed and therefore  
5       no one can say or confirm that Yucca Mountain is an  
6       acceptable site, although there is a lot of judgment on  
7       the part of the U.S. geological survey that it is a  
8       good site and there is good rationale as to why that  
9       site was chosen as the initial site to characterize.

10                   But I would certainly agree that it  
11       hasn't been confirmed as a suitable site, which is the  
12       only finding that you could come to at the end of a  
13       detailed site characterization program as they are  
14       planning to, and that is some time off. So, in a way,  
15       there is still obviously considerable time before a  
16       repository could be implemented there.

17                   Q. And the reference to firm political  
18       opposition wouldn't have much to do with detailed  
19       engineering of the site or sampling of the site. The  
20       fact is that there are a lot of people in Nevada that  
21       don't want the site there. Is that your understanding  
22       of the situation?

23                   A. I don't know about a lot of people.  
24       I really don't know the politics of this situation.

25                   I am aware, having attended a conference

1 and visited the site there, I am aware that there are  
2 disputes at the senior or top political levels between  
3 the State and the U.S. Department of Energy. So,  
4 certainly it's not a straightforward process. But  
5 then, I suppose, in this field there rarely is a  
6 straightforward path to implementation of any  
7 industrial project.

8 MR. PENN: A. I would just like to add  
9 something, that in your article, State of the World  
10 1992, Exhibit 648.

11 Q. The Worldwatch article, Mr. Penn.

12 A. Yes. That the first point you are  
13 trying to establish, the result has been public  
14 opposition to nearly any attempt to develop radioactive  
15 waste facilities, reference 47, is the opinion of two  
16 private individuals, when I look at reference 47, and  
17 also it's the opinion of the one we have just been  
18 talking about in reference 52.

19 And the activities in the United States,  
20 like here in Canada, are really just under way. There  
21 have been extensive scientific and technical  
22 assessments of the Yucca Mountain area, there has been  
23 appointed by Congress a negotiator and person that  
24 would bring together the views of all people concerned  
25 which is separate from the Department of Energy, and

1 the process is just under way, and I would suggest that  
2 it is too early to make these types of statements.

3 [12:35 p.m.]

4 I'm not trying to suggest that the matter  
5 isn't going to be considered in a very grave sense and  
6 will meet difficulties, but I don't think that we have  
7 the knowledge yet because we haven't had the experience  
8 of proceeding.

9 Q. Mr. Penn, given your apparent  
10 familiarity with the situation, can you confirm that  
11 the State of Nevada had passed a law that forbade the  
12 burial of irradiated fuel in the state?

13 A. No, I don't have that knowledge, it  
14 may be the case, but I know in very recent times  
15 because I attended a conference in San Francisco just  
16 before Christmas, where the chief negotiator and person  
17 charged by Congress to start bringing matters together  
18 had invited all main interest groups, including  
19 Aboriginal U.S. North Americans, North American Indians  
20 to participate and he had had a positive response from  
21 the Chief of the area in Nevada that borders the Yucca  
22 Mountain area.

23 So I can't answer your question, but I  
24 can say that there are other activities going on that  
25 is allowing the process of reviewing this matter to

1 proceed.

2 MR. JOHANSEN: A. And I could just add  
3 that the Yucca Mountain site wasn't picked out of the  
4 blue. The Yucca Mountain site characterization program  
5 is the culmination of nearly 10 years of site screening  
6 and general site evaluation commencing with the  
7 enactment of the U.S. National Waste Policy Act in 1982  
8 following which there was required the identification  
9 of a number of potential sites across the U.S which was  
10 done and from that list of roughly 10, I believe it  
11 was, potential sites Yucca Mountain and Hanford in  
12 Washington and a site in Texas were recommended as  
13 having particular potential. And in 1987 I think it  
14 was when the Act was amended there was a decision to  
15 characterize the Yucca Mountain site, first, for a  
16 number of reasons that were put forth at the time  
17 instead of characterizing the three recommended  
18 candidate sites in parallel and part of the rationale  
19 was simply economics.

20 Q. Mr. Johansen, to get back to the  
21 point here, I'm talking about public opposition.

22 A. Yes.

23 Q. If we could move on to France,  
24 please. Still on page 59 under the bold text on the  
25 right column the author begins a discussion of France



1 and the second sentence says:

2 Since 1987, however, only one order  
3 has been placed for a new reactor and the  
4 program has faced serious challenges over  
5 safety, economics and waste management.

6 Mr. Johansen. Is it true that the French  
7 waste management program has faced serious challenges?

8 A. I couldn't agree that there were  
9 serious challenges. I wouldn't doubt that the public  
10 in France is as concerned about safety matters and  
11 environmental protection and waste management in  
12 general as they are in this country so that wouldn't  
13 surprise me.

14 However, the word serious challenges  
15 suggests that there's some debilitating factor at work  
16 here which is not my understanding.

17 Q. The paragraph goes on to talk about  
18 ANDRA, which is the French waste agency and if you turn  
19 over to page 60, the first full sentence on the page  
20 tells us that:

21 In January, 1990 in one of the  
22 countries largest anti-nuclear  
23 demonstrations since the late 70s, 15,000  
24 people marched in - I'm going to  
25 pronounce it Angers but I'm sure

1                   that's not right - against the  
2                   Maine-et-Loire site in west central  
3                   France.

4                   And that if you look on the previous text  
5                   that refers to a proposed investigation site for waste  
6                   burial.

7                   So we see that France, which is a country  
8                   that's used to nuclear power, is having some serious  
9                   public opposition problems. Wouldn't you agree now?

10                  A. Well, I mean, that's what it says.

11                  MR. PENN: A. I think this is one  
12                  person's view. As I stated earlier in my testimony,  
13                  having visited France fairly recently in January, I did  
14                  testify that France is continuing to construct up to  
15                  five nuclear stations that will be in-service by the  
16                  year 2000.

17                  Yes, in discussing the political  
18                  situation in France the Green party and the communists  
19                  have opposed and it may be if there's a future  
20                  coalition government that this could slow the program  
21                  in France.

22                  But I certainly wouldn't describe it as  
23                  serious challenges to their program and there may very  
24                  well have been a large anti-nuclear demonstration, but  
25                  I'm not familiar with whether this is by the German

1 border or whether it was related to German anti-nuclear  
2 sentiment or what.

3 Q. Let's move on to Germany. Bottom of  
4 that column we see a discussion of the public  
5 opposition that has frustrated the German government's  
6 attempts to develop high level waste burials, describes  
7 sit-ins at drilling sites. Are you aware of that  
8 situation in Germany, Mr. Penn?

9 A. Whereabouts are you reading, please?  
10 At the last -- the bottom of the left-hand column, is  
11 that where you're at?

12 Q. Yes. It says:

13 In Germany the controversy over  
14 radioactive waste mirrors that  
15 surrounding nuclear reactor construction  
16 which has come to a standstill with 21  
17 plants built.

18 A. Well, I don't know what that means.  
19 Particularly, I agree that no German utility has  
20 ordered a new plant in the last three or four years,  
21 but I don't have any facts on the current situation in  
22 Germany on its radioactive waste disposal program  
23 except that they have done extensive work in Germany to  
24 use their salt mines which, of course, is another media  
25 that it is quite appropriate for the disposal of

1 nuclear waste because if salt mines had any moisture or  
2 water associated with them they wouldn't exist in situ  
3 and that's why disposing of any form of waste in stable  
4 salt situation is an attractive proposition.

5 Q. Back to the public opposition point,  
6 please. In Germany, if you look at the right column  
7 the last full paragraph it says:

8 Public opposition has also  
9 frustrated the government's attempts to  
10 develop a high level waste burial site.

11 If we skip down a bit in the paragraph  
12 just in an attempt to save some time we see -- do you  
13 see the sentence that starts: Large protests, about  
14 halfway through?

15 A. Yes.

16 Q. It says:

17 Large protests erupted even before  
18 the official announcement...This is  
19 referring to a specific investigation of a site...  
20 2,500 people took over the drilling site  
21 for three months before police hauled  
22 them off and set up a secure camp from  
23 which scientific work could be  
24 undertaken.

25 Were you aware of that demonstration, Mr.

1 Penn?

2 MS. HARVIE: Mr. Chairman, if I may  
3 interject at this point before we go through every  
4 country in Europe.

5 Mr. Penn has advised Mr. Mondrow that he  
6 is not familiar with the situation in Germany and the  
7 details of this, to the extent that they are relevant  
8 at all, and you would like to hear evidence about them,  
9 should surely be brought forward in Mr. Mondrow's own  
10 case to the extent that you give him some direction in  
11 that regard.

12 MR. MONDROW: Mr. Chairman, I have been  
13 very happy to let the witnesses explain everything that  
14 they want to explain in their responses, as you know,  
15 and oftentimes the witnesses have told us what they are  
16 familiar with from other jurisdictions. I'm trying to  
17 establish perhaps what they are not familiar with from  
18 other jurisdictions.

19 THE CHAIRMAN: As long as you don't get  
20 into arguments with them. This is a paper in which  
21 obviously the person who wrote it has very, very strong  
22 views and is expressing them very strongly, and so I  
23 don't think it's very helpful, there's a lot of  
24 polemics in this particular paper.

25 But just ask the questions that you want



1 to ask but don't go into perhaps as much detail as you  
2 have been going into.

3 DR. CONNELL: It might be possible, Mr.  
4 Mondrow, for you to bring out the point you want to  
5 make by sampling rather than covering all the detail.

6 MR. MONDROW: I, in fact, Dr. Connell  
7 have tried to do that, I will try to continue to do  
8 that.

9 Q. Mr. Penn, I have asked you if you  
10 were aware of that demonstration and your answer to  
11 that is...?

12 MR. PENN: A. No.

13 Q. I'm going to take you to Sweden,  
14 please, because you have mentioned Sweden a couple of  
15 times. If you turn to page 61.

16 MR. MONDROW: And, Mr. Chairman, I can  
17 inform you that I don't intend to spend a lot more time  
18 going through the particulars, but Sweden has been  
19 mentioned and I would like to look at that excerpt.

20 Q. If we look at the left-hand  
21 paragraph, the first left-hand column, excuse me, the  
22 first paragraph it says:

23 Nuclear issues have torn up the  
24 social fabric of Sweden since the early  
25 70s.

1 Give me a moment and I'll take you  
2 precisely to the excerpt I want to ask you about and  
3 that will consolidate things. It's the top half of the  
4 right column, it says:

5 Public support for burying  
6 irradiated fuel in Sweden has not come as  
7 easy as with low level waste, however,  
8 protests halted efforts to site a  
9 permanent high level burial  
10 facility 10 years ago and efforts to  
11 explore other sites have met determined  
12 local opposition since then, even though  
13 opinion polls indicate that most Swedes  
14 would, in principle, accept a disposal  
15 site in their community.

16 Mr. Penn, you have testified to the  
17 Swedish situation. Are you familiar with that aspect  
18 of the Swedish situation?

19 A. I have some knowledge of the Swedish  
20 situation.

21 Q. And there is reference there to  
22 public opinion polls which, as you testified I believe,  
23 generally support in principle a disposal site, but is  
24 it true that actual sighting attempts have met fierce  
25 opposition?

1                   A. I'm not aware of the detail of  
2                   opposition in the past. I notice the article talks  
3                   about something that occurred 10 years ago.

4                   My knowledge is that, and there was a  
5                   recent conference in the fall of 1991, I am not quite  
6                   sure, it was near the French/German border, so I think  
7                   it was in France, where several papers were given from  
8                   Sweden, and it was stated quite clearly and  
9                   surprisingly really, to me, that currently Swedish  
10                  people, recognizing the importance of reliable energy  
11                  and what they benefited in the past from to their  
12                  economy and to their well-being are in favour, nearly  
13                  70 per cent, of disposal of irradiated fuel in  
14                  geological structures and nearly 60 per cent said that,  
15                  while they wouldn't necessarily welcome, they would not  
16                  object to the disposal of fuel in their general  
17                  vicinity.

18                  The other thing that's quite clear that  
19                  is coming out of Sweden, and I'm not sure whether I  
20                  testified to this matter or not, but the Parliament of  
21                  Sweden recently passed legislation which indicated that  
22                  the prior moratorium or the prior shutdown of nuclear  
23                  plants starting in 2005 was now not going to occur and  
24                  would be delayed.

25                  So, quite a change happened in Sweden

1 after a great deal of debate at the public level and  
2 within their parliament.

3 Q. Mr. Penn, my understanding of the  
4 Swedish situation is that in fact the question is  
5 whether or not to stop generation power with nuclear  
6 but exactly how to phase it out; is that right? You  
7 mentioned that.

8 A. Would you mind repeating the  
9 question, please.

10 Q. Certainly. You mentioned that the  
11 phase-out period has been altered or extended or that  
12 the time frame has been extended at least for the  
13 decision-making.

14 My understanding of the Swedish situation  
15 is that the debate is not whether or not to continue  
16 with the nuclear moratorium, it's exactly how and when  
17 to phase out existing nuclear plants; is that right?

18 A. Well, I think, Mr. Mondrow, that your  
19 information is out of date. I can't put my finger on  
20 it but I know I have information with me that is not  
21 the case at all.

22 As I have just stated, the Swedish House  
23 of Parliament have passed a resolution in 1991 which  
24 indicated that the previous suggestion of phasing out  
25 nuclear power would now not occur starting in 2005.

1 Q. Yes.

2 A. And the legislation was silent on  
3 whether it would be phased out before its lifetime  
4 service.

5 Q. So you don't know?

6 A. So there is no question in Sweden  
7 today of proceeding to phase out those nuclear power  
8 plants.

9 Q. By those years?

10 A. I will repeat again, Mr. Mondrow,  
11 that in the House of Parliament they passed a law that  
12 said they would not phase them out on those dates, they  
13 were totally silent on whether in the future they  
14 would.

15 Q. Okay. I won't take you through the  
16 rest of the article, Mr. Johansen, but for the  
17 countries Japan, Russia, South Korea, Argentina and  
18 Taiwan, are you familiar with situations in any of  
19 those countries where there has been opposition to  
20 sighting a waste burial facility, nuclear fuel?

21 MR. JOHANSEN: A. Not in any detail. I  
22 could simply offer my general reaction that the extent  
23 to which any project meets with acceptance from the  
24 public who are potentially affected by them depends, I  
25 would think, to a large degree on their understanding



1 of the need, the number of alternatives that have been  
2 considered on the way, the extent to which they have  
3 been involved in the decision-making process.

4 I suggest to you that in many of the  
5 cases that you have taken us through there is no clear  
6 indication that the public were involved in the review  
7 of the principle or the basic technology such as we are  
8 trying to do in this country now.

9 We had our setbacks earlier in the  
10 nuclear program in trying to characterize potential  
11 sites for a repository and that led nowhere and, in  
12 fact, led to the Hare Commission making its  
13 recommendations to the federal government and the  
14 establishment of this program which we are in, and the  
15 novel feature of this program is the research and  
16 development and concept assessment phase prior to any  
17 site selection, and the consultation and federal  
18 environmental assessment review of the concept prior to  
19 any siting.

20 I think that has not been practised  
21 universally and I would think - I don't know all the  
22 details in every situation around the world - but I  
23 would think that the lack of that kind of concept  
24 before site assessment and the involvement of concerned  
25 public in that decision-making process has been part of

1 the reason for the questioning and opposition that has  
2 been experienced.

3 And the survey which was conducted by the  
4 gallop polling firm in 1990 of so-called opinion  
5 leaders in this country, and these opinion leaders were  
6 sampled from elected officials at both the federal  
7 government level and within the Provinces of Ontario,  
8 Quebec and New Brunswick for obvious reasons, and  
9 focusing on environment, energy, labour, transport and  
10 health departments as well as opposition critics  
11 corresponding to these portfolios.

12 The general survey of opinions of these  
13 leaders indicates that the majority -- well over 70 per  
14 cent believe that there is a clear need to implement  
15 permanent disposal facilities.

16 [12:55 p.m.]

17 There is a high degree, 80 per cent,  
18 roughly, a high degree of confidence that we have the  
19 technology in this country to do so.

20 There is some division of opinion on  
21 whether there should be -- whether the operational  
22 period of the repository is an adequate period for  
23 monitoring purposes. Roughly half of them feel that  
24 that would be long enough to monitor it before finally  
25 sealing it up and rendering it a disposal facility.

1 Roughly the other half of the opinion leaders feel that  
2 there would be a need for further monitoring, and of  
3 those that feel further monitoring is required, they  
4 would feel much more comfortable with the idea of  
5 continued environmental monitoring past the closure  
6 point.

7 I think that all of that in the context  
8 of the Canadian program, with concept assessment up  
9 front, is what we need to look at.

10 And finally I could add the point that  
11 there has been a lot of effort put into the development  
12 of more participatory siting programs, or siting  
13 procedures for purposes of siting a low level  
14 repository for federal waste, and that certainly is an  
15 experience. That is a process that clearly is going to  
16 be to be reviewed in this federal EA process on the  
17 high level or the used fuel concept.

18 THE CHAIRMAN: That's quite a long answer  
19 to the question that was asked.

20 MR. JOHANSEN: Yes, I apologize for that.

21 THE CHAIRMAN: It doesn't have much to do  
22 with the countries that you were asked about; in fact,  
23 it had nothing to do with the countries that you asked  
24 about.

25 MR. JOHANSEN: No.

1 THE CHAIRMAN: Could we stop now, Mr.  
2 Mondrow.

3 MR. MONDROW: I think so, Mr. Chairman.

4 THE CHAIRMAN: And regroup at 2:30.

5 MR. MONDROW: Yes. Thank you:

6 THE REGISTRAR: Please come to order.

7 This hearing will adjourn until 2:30.

8 ---Luncheon recess at 1:00 p.m.

9 ---On resuming at 2:25 p.m.

10 THE REGISTRAR: Please come to order.

11 This hearing is again in session. Be seated, please.

12 THE CHAIRMAN: Mr. Mondrow?

13 MR. MONDROW: Thank you, Mr. Chairman.

14 This morning went a bit slower than I had anticipated.

15 We will still be finished by the end of the day, and I  
16 am still aiming for the afternoon break. I will do my  
17 best.

18 I have also alerted Martin Campbell from  
19 Public Health, so he is aware of how we are proceeding.

20 THE CHAIRMAN: Thank you.

21 MR. MONDROW: Q. I just want to clear  
22 something up before I continue please, witnesses.

23 Mr. Penn, could you open page 29 of our  
24 interrogatory package.

25 Mr. Johansen, you were involved, the two

1 of you, you will recall that we were discussing  
2 contingency and I thought I made an error in my  
3 calculation. It struck me over the lunch break how I  
4 had come to the roughly 30 per cent determination.

5 If we are calculating a contingency for  
6 the total of -- let me backtrack for a second. The  
7 system repository total is 1,972 million 1990 dollars,  
8 and I added up all the numbers broken out of that  
9 including the contingency number, and I came up with  
10 that total. But if we are going to calculate what  
11 contingency factor has been applied to capital costing,  
12 it seems to me that we first have to subtract it from  
13 1972 total and then do our division. So having done  
14 that I came up with the contingency of, I believe it  
15 was, 28.7 per cent.

16 Can you confirm, Mr. Penn, that that's in  
17 fact the way we should work with these numbers?

18 MR. PENN: A. Yes, I would agree with  
19 you that I guess in the heat of the moment I was  
20 looking for a number to divide the contingency by in  
21 order to get a percentage and I agree with you that  
22 that's the appropriate way doing it.

23 Q. So we can assume then that all your  
24 comments though about the 22 per cent and the  
25 appropriateness of that number would now apply to the



1 28.7 per cent?

2 A. I don't have any difficulty with that  
3 sort of contingency.

4 Q. Okay. I just wanted to clear that  
5 up. Thank you.

6 Just to sum up what we were talking about  
7 before lunch, the world-wide public reaction to  
8 attempting to site a used fuel disposal facility. Mr.  
9 Johansen, would it be accurate to say that Ontario  
10 Hydro was assuming that educating the public about the  
11 technical feasibility of the repository project will,  
12 it is assumed, overcome the emotional reaction of those  
13 who are against the siting of a facility in their area?

14 MR. JOHANSEN: A. I'm not sure that we  
15 are necessarily assuming that it will overcome all  
16 concerns. I can say, however, that we recognize that  
17 it is important to work at that, and I would also add  
18 that we think it is important not just to try to  
19 educate, but I think important also to listen to what  
20 really is at the bottom of people's concerns and to try  
21 to incorporate in the implementation plan measures that  
22 respond to those concerns. In other words, it's not  
23 just a public relations exercise that's required here.  
24 Education is important, but we believe that we have  
25 been trying to listen to what people have been saying

1 and we have modified the disposal implementation plan  
2 particularly in the area of monitoring, to respond to  
3 what it is that concerns people about disposal.

4 Q. In your planning and your scheduling,  
5 you don't assume a protracted period of public  
6 opposition which in fact stalls your efforts. You  
7 assume that your public information or liaising  
8 sessions will overcome many the public concerns; is  
9 that fair?

10 A. I suppose if you look at it in that  
11 way, we are assuming that, yes, we would be able to  
12 overcome concerns, at least to the extent where the  
13 decision-makers on behalf of all of the people will be  
14 comfortable with approving or accepting the proposal  
15 and allowing to proceed, yes.

16 Q. You testified also before lunch, I  
17 think we were talking about the distances and the  
18 reason for the 1,000 kilometres, and you mentioned the  
19 centroid of, I believe, the northern and central  
20 Canadian Shield as the location within which you  
21 centered the destination for the transportation, did I  
22 hear you right?

23 A. Something like that. For generic  
24 concept assessment purposes, the Canadian Shield  
25 portion within Ontario was subdivided into what we

referred to as northern, central and southern regions.  
I was simply making the point that the approximate  
distance from our reactors to each of the centre  
points, for lack of a better assumption to make about  
transportation distances, was equivalent to roughly  
1,600 kilometers for the most distant region, 1,000  
roughly for the central region, and a few hundred  
kilometres, I believe around 400, for the southern  
region.

Q. In terms of actually siting the  
facility. Quite a part from the costing exercise, and  
I know you discussed this a little bit with Mr.  
Greenspoon, is it fair to say that the assumption is  
that this site will be in Northern Ontario?

A. Not at all. The question of siting  
hasn't been prejudged whatsoever.

The only assumption that we have made is  
that it will be somewhere within the Ontario portion of  
the Canadian Shield, and that ranges down into southern  
Ontario, as I believe I explained to him.

I know a lot of people jump to the  
conclusion that the Canadian Shield is only in Northern  
Ontario and therefore it will be in Northern Ontario,  
but I have never said that and we have not been  
prejudging site selection.

1                   It will be somewhere within the Canadian  
2     Shield and we assume within the Ontario portion of the  
3     Canadian Shield, consistent with the recommendation of  
4     the Hare Commission back in 1977.

5                   Q. Okay. It is possible, though, that  
6     the site could be in Northern Ontario?

7                   A. Oh, certainly.

8                   Q. And if it were in Northern Ontario,  
9     it seems to me that you would end up, wherever you put  
10    it, somewhere in the vicinity of a native community; is  
11    that a fair assumption?

12                  A. Well, I think that's speculative. On  
13    the other hand, I would agree with you that there is a  
14    possibility that the site would be within an area where  
15    native concern would be significant, but I would expect  
16    that the siting criteria yet to be established would  
17    include some priority on avoiding important land uses  
18    including native lands.

19                  That's about all I can say, I think.

20                  Q. Should you, in fact, end up somewhere  
21    near a native community, would you anticipate that the  
22    native community could be adverse in their reaction to  
23    siting attempts?

24                  A. I think that's difficult to say. It  
25    would depend on how we approached it.

1 I believe that there was evidence given  
2 during Panel 6, the hydraulic panel, evidence  
3 pertaining to a new planning approach for hydroelectric  
4 development purposes involving some elements of  
5 co-planning. I can't say whether approach would be  
6 applicable to other areas of Ontario Hydro development  
7 planning. But clearly what it indicates is that the  
8 location of any Ontario Hydro facility in the areas  
9 where there are native interests is going to be done in  
10 a way that is acceptable to native groups and  
11 government and other public groups that are concerned.

12 Q. So a co-planning process would be a  
13 possibility then, that's why you raised it?

14 A. It would Alberta possibility and  
15 that's what now is in the works for hydroelectric  
16 development planning.

17 Q. But would it be your evidence that it  
18 is premature? You haven't actually done any consulting  
19 with any native communities yet, you don't know who to  
20 talk to yet?

21 A. No. We are not in a siting phase at  
22 all and I have been very careful to avoid suggesting  
23 that we are developing a siting process. That is one  
24 of the areas that will be examined by the federal  
25 environmental assessment panel.



1 Q. I suppose two other concerns, should  
2 you end up in Northern Ontario, would be Aboriginal  
3 land claims and native self-government issues; would  
4 you agree with that?

5 A. I would expect those would be issues,  
6 yes. They are issues that have already been identified  
7 and we will have to deal with them depending on where  
8 the siting program takes us eventually.

9 Q. I know you have also testified that  
10 the actual transportation modes haven't been finalized,  
11 you are assuming some mixture, but would it be fair to  
12 say that a good part of the transportation would be  
13 along the existing rail lines?

14 A. If the rail mode indeed is used as  
15 part of the overall system, I would expect for the  
16 large part existing rail lines would be used, yes.

17 Q. Have you consulted with the rail  
18 transportation union at all about the carriage of  
19 radioactive waste?

20 A. The union?

21 Q. Yes.

22 A. I am not sure if the consultation has  
23 included the union, but there has been consultation  
24 with the transportation authorities and the  
25 transportation departments in government, and marine

1 consultants, and so on, to assess the technical  
2 feasibility and operational constraints, and so on.

3 There has been consultation with members  
4 of the public and special interest groups on general  
5 issues pertaining to transportation, whether it be  
6 road, rail or water.

7 Q. Are you aware whether the rail  
8 transportation union has a position, a stated position  
9 on the transportation of irradiated fuel?

10 A. I believe something came out during  
11 the federal panel scoping process, but I don't recall  
12 exactly what it was, no.

13 Q. Okay. Mr. Penn, when speaking with  
14 Mr. Poch you testified that there is no relationship at  
15 all between the date a decision can be expected on the  
16 repository concept and starting a new nuclear facility.  
17 And you told Mr. Poch that the hypothesis was totally  
18 theoretical and of no value. Do you recall that  
19 testimony?

20 MR. PENN: A. I don't recall those exact  
21 words--

22 Q. Perhaps we should turn it up.

23 A. --but I agree that there is no  
24 connection between the date of the repository and the  
25 date of any new nuclear station.

1 Q. I will take to you the transcript  
2 reference so we can see exactly what was said. It's  
3 Volume 137, page 24090. At line 11, Mr. Penn, you  
4 answered:

5 Well, I think it is a theoretical  
6 supposition and I don't think it has any  
7 value.

8 A. Yes.

9 Q. Could you turn to page 14 of Exhibit  
10 647, please. 647 is the package of IPPSO materials.

11 THE CHAIRMAN: Go ahead, Mr. Mondrow.

12 MR. MONDROW: Thank you, Mr. Chairman.

13 Q. Page 14 of our exhibit is the cover  
14 page from a consolidation of the Warren-Alquist Act  
15 which is currently in force in California.

16 If you turn to the next page, page 15 of  
17 Exhibit 647, I am looking at paragraph 25524.2. The  
18 legislation says:

19 No nuclear fission thermal power  
20 plant, including any to which the  
21 provisions of this chapter do not  
22 otherwise apply, but accepting those  
23 exempted herein, shall be permitted land  
24 use in the State, or where applicable, be  
25 certified by the Commission until both

1 conditions (A) and (B) have been met.

2 [2:50 p.m.]

3 And looking to condition A we see:

4 The commission finds that there has  
5 been developed and that the United States  
6 through its authorized agency has  
7 approved and there exists a demonstrate  
8 technology or means for the disposal of  
9 high level nuclear waste.

10 Mr. Penn, were you aware of this  
11 legislation when you testified to Mr. Poch two weeks  
12 ago?

13 MR. PENN: A. I don't think so. I think  
14 your materials came to us following that and I  
15 certainly wasn't aware of the law in the State of  
16 California.

17 But when I answered, going back to Volume  
18 137 of the transactions and on page 24090, what I was  
19 referring to was the fact that there is no -- to my  
20 knowledge, there is no law or direction that we should  
21 have approval of the concept technology of a repository  
22 for used fuel.

23 Q. I'm sorry, Mr. Penn, you are telling  
24 me now that that testimony was that we don't have a  
25 law, that is what you were saying at those pages?

1                   A. I'm not aware of a law in Ontario  
2           that says we have to have an approved technology for  
3           used fuel disposal.

4                   I am aware that the Hare Commission,  
5           possibly the Porter Commission, indicated that it was  
6           highly desirable that significant progress had been  
7           made on the development of the technological concept of  
8           used fuel disposal by the time the next nuclear plant  
9           is approved.

10                  And I think that Dr. Porter is on record  
11           of saying that he, for one, is certainly satisfied that  
12           sufficient progress is being made.

13                  Q. Mr. Penn, isn't it true that Mr. Poch  
14           was asking you whether -- I'm sorry, perhaps we should  
15           turn up the transcript, I don't want to put words in  
16           your mouth.

17                  Again, this is Volume 137, page 24090,  
18           top of the page Mr. Poch says:

19                         "Mr. Penn, I am not asking for your  
20                         judgment on that question. I am simply  
21                         asking for your judgment that if it was  
22                         felt that it would be appropriate before  
23                         making a decision on committing to  
24                         nuclear expansion in Ontario that we  
25                         await the decision on the concept, for



1 example?"

2 And your answer was:

3 "Well, I think it is a theoretical

4 --"

5 A. Well, just a minute. Excuse me.

6 Q. Let me finish the transcript and I

7 will be happy to hear what you have to say. Your

8 answer was:

9 "Well, I think..."

10 THE CHAIRMAN: Wait a minute. You

11 haven't read the whole question yet though.

12 MR. MONDROW: Q. Okay. The rest of the

13 question is:

14 "All I am saying is there is no

15 conflict there because that decision is

16 in fact expected prior to the commitment

17 date that you have identified given

18 the lead times, given a need date of

19 2010; correct?"

20 And your answer is:

21 "Well, I think it is a theoretical

22 supposition and I don't think it has any

23 value."

24 I guess in face of the California

25 legislation it's fair to say that your evaluation of

1 whether waiting for a decision on the concept has any  
2 value is not shared by some of the legislators in the  
3 United States; is that right?

4 MR. PENN: A. Well, before I answer that  
5 question, I think we better look at what Mr. Poch was  
6 asking me and see that we understand it properly.

7 If we look at the first paragraph, he's  
8 saying, if we disregard the first sentence, I am simply  
9 asking for your judgment that if it was felt...

10 Q. Yes?

11 A. If. So that is a hypothesis, it's a  
12 theoretical supposition, if--

13 Q. Yes?

14 A. --that it would be appropriate before  
15 making a decision on committing to nuclear expansion in  
16 Ontario that we await the decision on the concept.

17 Q. Yes. And your response is, you felt  
18 that that hypothetical had absolutely no value; right?

19 A. Well, I said it on the basis of the  
20 reality of the situation. The reality of the situation  
21 in Ontario is that there isn't a law such as that in  
22 California.

23 Q. Mr. Penn, it could be the decision of  
24 this Board, for example, that we should wait on nuclear  
25 until at least the concept is approved.

1                   A. Well, Mr. Poch didn't ask me that  
2 question.

3                   Q. No, but the hypothesis that we should  
4 wait until the concept is approved, do you think that  
5 that hypothesis has any value?

6                   A. There is no requirement in law to  
7 consider that, first of all, and I think it's a  
8 hypothetical question.

9                   Q. Indeed it's hypothetical.

10                  A. I really don't have anything further  
11 to say on it than I have said.

12                  Q. Okay. Mr. Penn, you testified you  
13 weren't aware of the legislation. I take it then that  
14 you can't confirm whether it's true that seven other  
15 states in the United States are considering similar  
16 legislation?

17                  A. I don't know.

18                  Q. And you are not aware that in  
19 California the California Public Utilities Commission  
20 in fact implemented the legislation in 1978 by denying  
21 approval for the Sun Desert Nuclear Project?

22                  A. I have no knowledge of that.

23                  Q. You can concede, I think, that it's  
24 the next generation that will be disposing of our  
25 nuclear debris, not us?

1 A. Yes.

2 Q. Thank you.

3 A. But with the technology that is  
4 provided by this generation and in the approvals  
5 process of this generation.

6 Q. If you could open our interrogatory  
7 package, please, Mr. Johansen, to page 40.

8 MR. JOHANSEN: A. Yes, I have it.

9 Q. Again, this is the report on the  
10 repository concept that we have been looking at  
11 attached to interrogatory 9.7.19.

12 And I know that others have discussed the  
13 schedule with you and I'm not going to revisit that  
14 discussion, I just have one question on it which has  
15 not been covered yet.

16 If you look at the third last bullet on  
17 the table which contains the schedule it says panel  
18 holds meetings and public hearings, and the dates given  
19 there in brackets are 1992 and 1993.

20 Now, the previous entry or entries have a  
21 mid-1992 completion date and the entry after that, the  
22 panels report has a mid-1993 date.

23 By my calculations that leaves about six  
24 months for the public hearing. Giving the panel six  
25 months to prepare their report, and even if you give

1 the panel a little less time, you are still talking  
2 maybe eight months for the public hearing.

3 Does that seem a little short to you,  
4 given the concerns that we have seen around the world  
5 for the sighting of a nuclear fuel repository?

6 THE CHAIRMAN: Yes, Ms. Harvie.

7 MS. HARVIE: I just wish to point out,  
8 maybe Mr. Mondrow is not aware of this, but we had lead  
9 some evidence in chief on this and there's an overhead  
10 where we set out a more up-to-date schedule.

11 It's certainly not contemplated by any  
12 means that a hearing would take place within the next  
13 six months.

14 MR. MONDROW: I'm sorry, maybe I misspoke  
15 my question. I am aware of the overhead.

16 THE CHAIRMAN: I think he's asking about  
17 the length of hearing once the hearing gets started;  
18 isn't that right?

19 MR. MONDROW: Yes, Mr. Chairman, that is  
20 right.

21 Q. If I understand the overhead we are a  
22 little later now because of the delays in the process,  
23 but the relative dates are still the same. That's  
24 right, Mr. Johansen?

25 MR. JOHANSEN: A. There has been no



1 procedural wrinkles added to the review process since  
2 this was written back in 1989, however, I think there  
3 was a good deal of judgment involved in suggesting  
4 these dates and I would say in retrospect that they  
5 look somewhat optimistic.

6 I don't believe that the authors of this  
7 particular report would have assumed that the hearings  
8 could be squeezed into a time span as short as six  
9 months.

10 My general understanding of the  
11 assumptions around Ontario Hydro in that regard  
12 certainly, I have not seen estimates as short as that,  
13 unless someone was trying to answer the question under  
14 the most optimistic circumstances what would be the  
15 earliest date by which a government decision on the  
16 concept could be made.

17 But I think the duration of the entire  
18 review process would certainly, in any reasonable  
19 scenario, range beyond six months.

20 Q. I'm searching for your overhead that  
21 Ms. Harvie has referred to.

22 A. Yes.

23 Q. It's page 56 actually of Exhibit 519  
24 and the dates pre-1995 are not broken out there at all.  
25 Is your assumption any different then from that that we

1 see in this report?

2 A. Yes.

3 Q. That overhead takes you from...

4 A. I can confirm what you are saying,  
5 that the overhead which I have presented in direct was  
6 an overhead of milestones from the point of concept  
7 acceptance decision which was assumed to in-service, so  
8 it doesn't really address that question.

9 A better source of information, more up  
10 to date at least than the interrogatory response or the  
11 report that we are looking at would be the Used Fuel  
12 Plan Document which I have referred to several times.

13 Q. Can you tell us what the hearing  
14 schedule supposition is in there?

15 A. I'm not sure if it's really given in  
16 great detail, but perhaps I can -- from figure 5-3  
17 which appears on page 21 of that document and just for  
18 the record this is Exhibit 520.20.

19 Q. Sorry. Could you give me the page  
20 number again?

21 A. Page 21. What it indicates here is  
22 that the concept EIS is submitted in late 1992 - now,  
23 again, that has been shifted because of the delay in  
24 the guidelines - and it indicates concept approval in  
25 late 1995 and, therefore, the time interval for EIS

1 review and hearings, as a total, is roughly three  
2 years.

3 Q. But it doesn't break down the hearing  
4 schedule?

5 A. This does not break it out in terms  
6 of the actual time assumption for the hearings per se  
7 as distinct from other stages in the total review  
8 process.

9 There are schedules that are being  
10 prepared now for purposes of detailed cost estimating  
11 that are addressing that, but I don't have that at my  
12 fingertips, but I think that gives you some idea.

13 Q. Well, that three-year period would be  
14 exactly the same three-year period that we saw in the  
15 schedule in the report, so nothing in there has  
16 changed?

17 A. Yes.

18 Q. Okay. In light of the comments that  
19 we saw in the CNA brief when we were looking at that at  
20 the outset of my examination on public hearings, would  
21 it be fair to say that the length of that hearing will  
22 be heavily weighted by the amount of funding granted to  
23 parties adverse in interest to the establishment of  
24 that disposal facility?

25 A. You are suggesting there's a

1 relationship--

2 Q. I am suggesting.

3 A. --between the timing and amount of  
4 participant funding?

5 Q. That if there is funding granted to  
6 groups who oppose the concept, the hearing could be  
7 substantially longer than six months.

8 A. Well, I guess I can't really comment  
9 on that because that's speculative. However,  
10 regardless of participant funding, I am sure the issue  
11 is one that will generate considerable participation  
12 and it's not going to be a trivial review process and I  
13 would expect that it would take a substantial amount of  
14 time.

15 Whether the authors of this particular  
16 table have correctly allocated six months out of the  
17 total three-year review process accurately or not is  
18 arguable, I suppose, but I don't think too much hangs  
19 on that particular allocation.

20 I think the scheduled provision for the  
21 whole review process is three years and I think that is  
22 a more useful figure.

23 Q. Could you turn to page 12 of the  
24 report that we have out in our interrogatory package  
25 which is page 45 of the package.

1 THE CHAIRMAN: Sorry, I didn't pick that  
2 up. What is it?

3 MR. MONDROW: It's page 45 of the  
4 interrogatory package, it's page 12 of the report that  
5 we have been looking at.

6 THE CHAIRMAN: Thank you.

7 MR. MONDROW: Q. In the first paragraph  
8 at the top we are given a list of the R&D contributions  
9 by Ontario Hydro to the used fuel disposal program from  
10 1987 until 1994 which was then the assumed concept  
11 approval date.

12 Can you tell me roughly how much those  
13 contributions total, Mr. Johansen?

14 MR. JOHANSEN: A. Well, I believe, Mr.  
15 Penn in fact testified in his direct evidence on this  
16 very subject.

17 Q. Mr. Penn, do you have a total figure  
18 for those?

19 MR. PENN: A. You are talking about the  
20 total funding from Ontario Hydro to Atomic Energy of  
21 Canada with regard to--

22 Q. The used fuel disposal facility?

23 A. --used fuel disposal development?

24 Q. Yes, sir.

25 A. Well, I don't think I did testify to



1 that, at least if I did I have forgotten.

2 Q. So have I.

3 MR. JOHANSEN: A. I wasn't suggesting  
4 totals by the way, I was talking about annual levels.

5 MR. PENN: A. But the current -- as it  
6 says in here, Ontario Hydro has significantly increased  
7 its contribution through the CANDU owners group to an  
8 average of 13 million per year to give you -- and I  
9 presume they started counting from about 1979. Today's  
10 contribution is about \$20 million per year, so --

11 Q. I'm sorry.

12 A. So if I did some approximate  
13 arithmetic I would think that our total contribution  
14 has now been certainly over \$120 million.

15 Q. Okay, that's helpful. Is that money  
16 included in the cost estimate for the repository plan?

17 A. No, because it's current OM&A funds.  
18 What we are talking about is a conceptual study and  
19 conceptual studies are paid for out of OM&A, corporate  
20 OM&A.

21 Q. So it's corporate OM&A, it's not  
22 allocated to nuclear OM&A?

23 A. Well, it's allocated from the  
24 corporation to design and construction branch through  
25 the CANDU owners group department and is approved by

1 our board of directors.

2 Q. Not reflected though in the nuclear  
3 OM&A figures that you have given us or projected?

4 A. Not for the operation of the current  
5 nuclear generation stations. This is other corporate  
6 OM&A, same category as all sorts of research we do, for  
7 example, on alternative energy systems.

8 Q. Right. Significantly less money on  
9 alternative energy systems though; right?

10 A. Well, compared with the number of  
11 alternative energy plants we have got, it's quite  
12 significant.

13 Q. That's true. Would you turn back to  
14 Exhibit 648 please, the Worldwatch article, page 65,  
15 please.

16 There's an interesting statement made by  
17 the author, which I would like to put to you, it's in  
18 the last paragraph on that page, it's the first  
19 sentence.

20 Mr. Johansen, it says:

21 Even if no more nuclear waste were  
22 created, addressing that which already  
23 exists will require attention and  
24 investments for a period that  
25 defies our usual notion of time.

1                   We have talked about that a bit in terms  
2 of time before. Would you agree with that statement?  
3 [3:10 p.m.]

4                   MR. JOHANSEN: A. Well, I would  
5 certainly agree that there is a need for development of  
6 a solution to the nuclear waste problem regardless of  
7 whether we build another reactor. So that part of it I  
8 can certainly agree with.

9                   And I can agree that the nature of the  
10 material, the radioactive materials, whether it's used  
11 fuel or in other jurisdictions high level waste from  
12 reprocessing, the nature of that material requires  
13 careful management for a very long time.

14                  And in the minds of some, that period of  
15 time might be well beyond their usual notion of time as  
16 the article says. But I would like to differentiate  
17 between the period of time over which radionuclides are  
18 potentially hazardous, and the period of time over  
19 which the performance of a repository has to be  
20 assured. Those time periods are quite different. But  
21 in any sort of notion of time, it's a long-term  
22 challenge.

23                  Q. Are you saying that the period time  
24 over which the repository has to perform is less than  
25 the period of time over which the contents are

1 potentially hazardous or more?

2 A. At least the engineered part of the  
3 concept.

4 What I am saying is that after less than  
5 500 years, I have indicated this before, the hazard of  
6 the material as placed in the repository will be  
7 comparable to the hazard of a uranium ore body. That's  
8 not to say that if you were to take that material out  
9 that it wouldn't be hazardous for a long period of time  
10 after that, that is highly unlikely. That's the point  
11 I am trying to make.

12 Q. Could you turn to page 55 of the  
13 article, please. The second last paragraph on the  
14 right-hand column, it says:

15 The scientific uncertainties  
16 surrounding radioactive waste burial are  
17 enormous. According to a 1990 NRC report  
18 on radioactive waste disposal, the needed  
19 long-term quantitative predictions  
20 stretch the limits of human understanding  
21 in several areas of geology and  
22 groundwater movement and chemistry.

23 Would you agree with that statement, Mr.  
24 Johansen?

25 A. I'm sorry, I was looking at the page.

1 55.

2 Q. 55.

3 A. I see it, the scientific  
4 uncertainties.

5 Q. That's right.

6 A. And your question was do I agree with  
7 that?

8 Q. Yes.

9 A. No, not the way it's put here.

10 I wouldn't say that the uncertainties are  
11 enormous. I think there are uncertainties in  
12 characterizing geological environments in a broad  
13 regional context. And much of the uncertainty that's  
14 talked about in these reports are uncertainties that  
15 have been experienced in trying to develop a generic  
16 geosphere model for assessment purposes, and that I  
17 would agree is a very difficult, if not impossible,  
18 thing to do.

19 But scientists in the Canadian program  
20 certainly, and I believe elsewhere by now, have come to  
21 the realization that that (A), isn't necessary, and  
22 (B), is very difficult, and what really is necessary is  
23 the detailed characterization of a site, the site which  
24 would be proposed for the repository.

25 Q. I will ask you to move on to the next



1 part of that paragraph and we see excerpted an actual  
2 statement from the NRC report itself, and the excerpt  
3 says:

4 Studies done over the past two decades  
5 have led to the realization that the  
6 phenomena are more complicated than had  
7 been thought. Rather than decreasing our  
8 uncertainty, this line of research has  
9 increased the number of ways in which we  
10 know that we are uncertain.

11 Would you agree with that statement?

12 A. Well, I find it difficult to agree  
13 with that. I can't agree with it because I can't  
14 really determine who wrote that statement, what sort of  
15 person wrote that statement. The reference at the back  
16 doesn't provide much indication.

17 Q. It does say that it is from the NRC  
18 report.

19 A. Yes, that's true.

20 I'm not trying to say that there are no  
21 uncertainties. I certainly agree there are  
22 uncertainties.

23 What I also would like to point out is  
24 that many of the complexities that have been discussed  
25 by people in the scientific community are complexities

1 associated with the very site-specific nature of  
2 geology, in that there does not appear to be a pattern  
3 that can be used or transferred from one site to  
4 another. What is required is detailed site-specific  
5 model development for each and every case.

6 And furthermore, the Hydro geological  
7 characterization of a potential site area certainly is  
8 important but has to be considered together with the  
9 performance of the engineer barriers, which we can have  
10 greater confidence in for the relatively short-term at  
11 least, during which the material has to be particularly  
12 well cared for. So, hence, the distinction which I  
13 made earlier about the sort of 3 to 500-year period and  
14 the period after that.

15 Geology is a complex area of science and  
16 it is highly site-specific and it's easy to find  
17 uncertainties or describe the entire field as subject  
18 to many, many uncertainties.

19 Q. Mr. Johansen, the statement says that  
20 the line of research has increased the number ways in  
21 which we are uncertainty rather than decreasing it. Do  
22 you agree with that part of the statement?

23 A. Not in general.

24 Q. Are you familiar with the NRC report,  
25 Mr. Johansen?

1 A. Not this particular report, no.

2 Q. Finally, with this paper, still on  
3 page 55, at the bottom of the left column, last  
4 sentence says:

5 Finally, workers will erect some  
6 everlasting sign post to the future. In  
7 the one deal we propose a colossal  
8 Stonehenge warning generations millennia  
9 hence of the deadly radioactive waste  
10 entombed below.

11 I won't ask you to comment on the  
12 value-laden words in that paragraph.

13 A. I'm sorry, I didn't pick up where  
14 that came in.

15 Q. It's still on page 55, it's the  
16 bottom of the left-hand column.

17 A. Yes, I see it.

18 Q. My question is simply: If you are  
19 aware of the concern of marking the repository site.  
20 That's been a concern that people are starting to  
21 address?

22 A. Yes. That has always been one of the  
23 issues, the technical issues, social issues, I suppose  
24 as well, that people in the program have thought about  
25 and considered. I am aware that there are some studies

1 under way in the U.S. in that regard, in connection  
2 with the waste isolation pilot project in New Mexico.

3 So thought is being directed at how such  
4 a repository would be marked in future so that future  
5 generations would be adequately forewarned of the  
6 hazard below.

7 Q. If you turn up our exhibit package,  
8 647, second last page we have actually copied an  
9 article from the Globe and Mail which dealt with that  
10 topic. It's the second last page, Mr. Chairman, I am  
11 just trying to locate my copy, but when I was numbering  
12 the package I believe I inadvertently left a number off  
13 of that page, so it comes from 15 and 16. Perhaps for  
14 the record we should mark it 15A.

15 This article, Mr. Johansen, discusses the  
16 Marker Project which is I think the project you just  
17 referred to, convened by the U.S. Department of Energy.  
18 You can see a picture here of an architect's rendering  
19 of how they would mark the disposal site. And they are  
20 actually right now concerned with the remnants of their  
21 nuclear weapons program.

22 If you look at second column on the  
23 vertical bar, the bar at the left-hand side of the  
24 page, the second paragraph, you can see the concern  
25 expressed there:

1                   How does a society communicate that  
2                   danger - referring to the radioactive  
3                   debris below - when all known human  
4                   languages may no longer be spoken, when  
5                   war or natural calamity may have erased  
6                   all historical knowledge of the 20-year  
7                   process of radioactive waste interment.

8                   Then if you turn the page back upright  
9                   and look at the right most column in the third full  
10                  paragraph, it says:

11                  So in addition to warnings in a  
12                  variety of existing languages - unlikely  
13                  to be understood in the long run because  
14                  languages generally become extinct after  
15                  about 1,500 years...

16                  I take you to those references just to  
17                  give some structure to my comments. It seems to me  
18                  that the concern then there is, given that we are  
19                  talking a time so distant, how can we communicate to  
20                  people not to go digging around down there if we don't  
21                  even know they will be talking the same language as we  
22                  speak, is that a concern to your knowledge?

23                  A. That's a fair statement in general.

24                  I would only add that, as I believe I  
25                  indicated in my direct evidence, that after 500 years,



1 which certainly is not the sort of time range that they  
2 are considering here, after 500 years a person could be  
3 in the same room as a used fuel bundle and could handle  
4 it without danger.

5 The concern would only be if the bundle  
6 began to leak and some of the material were inhaled or  
7 ingested in such a way that it became fixed in the body  
8 and could continue to irradiate the body over a long  
9 period of time.

10 Q. And that latter concern goes out tens  
11 of thousands of years, we talked about that earlier.

12 A. Yes, but that would be a concern that  
13 would apply to many other materials that occur in  
14 nature and other manmade or anthropogenic materials  
15 that we take for granted and are not particularly  
16 concerned about.

17 We would have to be concerned about  
18 inadvertent boring or drilling into rich ore bodies,  
19 uranium ore bodies in future if technology were to be  
20 washed away.

21 So it wouldn't be a unique hazard, that's  
22 all I am saying.

23 It is important to address these matters  
24 and to take reasonable precautions. So, as a citizen,  
25 I am comforted that they are looking at these things.

1 Q. Has Ontario Hydro looked at how to  
2 mark its repository?

3 A. No, Ontario Hydro is not the  
4 proponent of the disposal concept. That is AECL's  
5 responsibility and, yes, I believe AECL has been  
6 thinking about this. In fact, I believe in the article  
7 here a comment is attributed to one of the senior  
8 managers at AECL.

9 Q. I can confirm in the middle column,  
10 which is again vertical at the top, it mentions  
11 Canada's 10,000 year repository. I don't remember the  
12 quote, but you may very well be right.

13 MR. PENN: A. All I would like to say is  
14 that I am surprised that languages could go out of  
15 existence in 1,500 years. I seem to recall the  
16 Scriptures date back to at least two-and-a-half  
17 thousand years.

18 Q. I'm sorry, which language is it? The  
19 Scriptures?

20 A. The Scriptures, the Bible.

21 Q. Yes, but not in the way they are  
22 written today.

23 A. Well, we have managed to understand  
24 them.

25 Q. Yes, translate them.

1 Douglas Point and the NPD, Mr. Johansen  
2 the first reactors in Ontario to be decommissioned or  
3 to move into the decommissioning phase of their lives,  
4 and the two reactors are now in safe storage mode;  
5 right?

6 MR. JOHANSEN: A. Yes, that's my  
7 understanding.

8 Q. And you have told us, and I won't go  
9 through this in any length, but your decommissioning  
10 process is three phase one, you defuel and dewater,  
11 and then you consolidate things and leave the reactor,  
12 monitor it for 30 years, and then after 30 years you  
13 dismantle it?

14 A. That's correct.

15 Q. How is the 30-year period arrived at,  
16 the 30-year safe store period?

17 A. I was not a party to that particular  
18 decision. Perhaps Mr. Penn who has been more involved  
19 in that could comment.

20 MR. PENN: A. Would you mind restating  
21 the question, please.

22 Q. How was the 30-year safe storage  
23 period arrived at?

24 A. I think it was mainly associated with  
25 the fact that the fields would be reduced by about a

1 factor of 1,000 and would therefore enable to us use  
2 conventional means to demolish the plant.

3 Q. The bulk of the actual  
4 decommissioning work, the demolishing, of course, comes  
5 in Phase 3. There is not a lot done to decommission  
6 before Phase 3; is that correct?

7 A. What is done before the final phase  
8 of demolishing the plant is the removal of the fuel and  
9 the removal of the heavy water, and the general  
10 security of the plant including appropriate  
11 environmental conditions such as temperature and  
12 humidity to maintain the plant in a habitable form.

13 Q. But the bulk of the work comes in  
14 Phase 3 then?

15 A. Yes, it does.

16 MR. MONDROW: Mr. Chairman, I am afraid I  
17 have some bad news, I will not be finished by the  
18 afternoon break. Perhaps we should take a break and  
19 then we will come back and wrap up following that.

20 THE CHAIRMAN: You will be finished  
21 before five o'clock.

22 MR. MONDROW: I will be finished the end  
23 of today, I promise.

24 THE CHAIRMAN: We will break for 15  
25 minutes.

1 THE REGISTRAR: Please come to order.

2 The hearing will take a 15 minute recess.

3 ---Recess at 3:30 p.m.

4 ---On resuming at 3:50 p.m.

5 THE REGISTRAR: Please come to order.

6 This hearing is again in session. Be seated, please.

7 MR. MONDROW: Thank you, Mr. Chairman.

8 Q. Mr. Penn, could you turn up Volume  
9 122 of the transcript, please, to page 21366.

10 MR. PENN: A. Did you say 21366?

11 Q. That's right.

12 A. Thank you.

13 Q. Starting at line 7, Mr. Penn, you're  
14 giving some testimony to support the confidence you  
15 have in your decommissioning plans and their costs, and  
16 you say:

17 "Our knowledge of how to safely  
18 remove highly active pressure tubes in  
19 retubing, our experience in assisting  
20 Atomic Energy of Canada Limited with  
21 their process of decommissioning the  
22 nuclear power demonstration plant and  
23 Douglas Point, and our involvement in  
24 other world decommissioning studies such  
25 as the Shipping Port Reactor in the



1 United States and our collaboration with  
2 the United Kingdom and Sweden gives us  
3 confidence in our decommissioning plans  
4 and their costs."

5 Now, my first question, Mr. Penn, I think  
6 we have just established before the break that for NPD  
7 and Douglas Point all you have done is defuel and  
8 dewater so far; right?

9 A. Yes.

10 Q. And the other world decommissioning  
11 studies that you refer to there, they are all  
12 perspective studies; right?

13 A. Yes. There's a great deal of study  
14 gone on on this subject.

15 Q. Yes. Is it fair to say that Ontario  
16 Hydro's decommissioning plans are also conceptual?

17 A. They are based upon knowledge of the  
18 intimate detail of the design of the plants, they are  
19 based upon extensive review of ideas with other world  
20 authorities in nuclear power, and they are based upon a  
21 step by step process of demolishing the plants and  
22 returning the land to the point where it can be used  
23 for other purposes.

24 Now, I'm not sure I would describe that  
25 as conceptual. I would describe it as a very thorough

1 review of the methods to be used but that have not yet  
2 been undertaken in Ontario.

3 Q. Could you turn to page 79 of our  
4 interrogatory package, please. Actually just to give  
5 you some context for this perhaps you should start off  
6 at page 56 of the package, just so we can establish  
7 that this is a response to interrogatory 9.6.8 which  
8 has already been given Exhibit No. 520.21 I believe.

9 And attached in response to that  
10 interrogatory we have a paper, the title page of which  
11 is at page 57 of our package, Conceptual Plan for  
12 Decommissioning Pickering, Bruce and Darlington  
13 Generating Stations.

14 I would like to take you to page 79 of  
15 our package which is page 15 of the paper, please.

16 A. Well, let's be clear for the record.  
17 This isn't a paper, this is a Design and Development  
18 Division, Nuclear Safety Department report duly  
19 prepared by certain authors, reviewed and approved.

20 Q. That's fine. Thank you for the  
21 correction.

22 And at page 15 of the report we see a  
23 table which sets out various dates for submitting  
24 reports to the AECB about decommissioning plans, so we  
25 see that you submit your final detailed decommissioning

1 plan a year before station shutdown and, in the case of  
2 Pickering A, that is 2011.

3 And then in 2037, which would be five  
4 years before the end of the storage period, I believe  
5 you demonstrate that planning is sufficiently advanced  
6 that the remaining decommissioning will likely be  
7 performed on schedule. Is that what that date  
8 indicates?

9 A. Well, the process is that there's a  
10 requirement of a regulatory document by the Atomic  
11 Energy Control Board which I think is Document R90 that  
12 says --

13 Q. I'll point you to a reference and  
14 I'll let you continue your explanation so people can  
15 follow. This is actually set out on page 14 of the  
16 report under regulatory schedule. Thank you.

17 A. Oh, I was looking actually at the  
18 introduction which is on your page 65.

19 Q. Okay.

20 A. And regulatory Document R90 requires  
21 as a condition for the licence to operate our nuclear  
22 plants to update or to confirm with the Atomic Energy  
23 Control Board that our plans are current.

24 So it's an ongoing process and it will  
25 naturally include any changes between now and, shall we

1 say, 2011 when Pickering A is currently due to go out  
2 of service.

3 At that time the AECB will require us to  
4 submit a very detailed work permit and then after -- in  
5 five years, as you note, before we start work they will  
6 require us to confirm that detailed work plan and its  
7 schedule to ensure that it will be done in the time  
8 period that we stated.

9 Q. And then there's another detailed  
10 plan, a final detailed plan I assume which is submitted  
11 one year before the dismantling starts?

12 A. Yes.

13 Q. That would be the third column. So  
14 for Pickering, the first station to be decommissioned,  
15 we're talking about the year 2041 for the final plan?

16 A. Yes. Well, it may be that by that  
17 time we will have laser type saws that we would use to  
18 saw through concrete rather than using a ball and  
19 chain.

20 Q. So, it's fair to say that the  
21 regulatory requirements and the technology and the  
22 costs won't be very well established until we get quite  
23 a bit closer to the dismantlement phase, things are  
24 going to change between now and 2041; is that fair?

25 A. Well, I think the costs are likely to

1 be less than more because, as I have stressed several  
2 times, that the position that Hydro has taken is that  
3 we should use methods and technologies currently  
4 available to us today, and I have just given you an  
5 example, that if you have a laser saw for cutting  
6 through four foot of concrete, then you would obviously  
7 do it.

8 Q. Can you turn to page 131 of our  
9 interrogatory package, please. This is interrogatory  
10 9.7.43 which needs a number, please, Mr. Lucas.

11 THE REGISTRAR: .141.

12 ---EXHIBIT NO. 520.141: Interrogatory No. 9.7.43.

13 MR. MONDROW: Q. This interrogatory  
14 talks about --

15 THE CHAIRMAN: 131?

16 MS. PATTERSON: 141.

17 THE CHAIRMAN: 141.

18 MR. MONDROW: I'm sorry, sir. It's page  
19 No. 131 of the package and the Interrogatory No. is  
20 520.141.

21 THE CHAIRMAN: All right, thank you.

22 MR. MONDROW: Thank you.

23 Q. If you look at the last sentence of  
24 the response, please - we'll come back to the rest of  
25 it in a second - it's talking about the contingency



1 factor for decommissioning in the Darlington study and  
2 the last sentence says that:

3 "The decommissioning factor also  
4 reflects the fact that the Phase  
5 3 activities will not start until about  
6 the year 2060, at which time the other  
7 required technologies will have matured."

8 Mr. Penn, doesn't Ontario Hydro assume  
9 that the technologies that they will in fact have to  
10 use will be mature when the time comes, not that they  
11 are going to use the technologies in existence today  
12 necessarily?

13 MR. PENN: A. It says that the size of  
14 the contingency factor reflects the fact that many  
15 activities use well-established methods.

16 We're talking about -- you can't say a  
17 method is well established unless you know it today.

18 Q. And then reading on it says it also  
19 reflects --

20 A. Yes.

21 Q. Goes on to the sentence which I just  
22 read which talked about technologies which you're  
23 assuming will have matured by the time you get there.

24 A. Yes, such as the example I have just  
25 given you.

1 Q. And when you gave me that example you  
2 said you assumed that you would use current  
3 technologies and not those yet to mature technologies,  
4 but that is not what this answer seems to indicate.

5 A. What I said was, for costing purposes  
6 and for planning purposes and for gaining credibility  
7 with people like yourself and the Atomic Energy Control  
8 Board that we are not suggesting using technologies  
9 that you can imagine, but those that we know today.

10 But it only makes sense that since  
11 Darlington isn't going to be decommissioned until, I  
12 think it's after the year 2060, that you wouldn't use  
13 technologies that have matured by then. That's all I  
14 understand this answer means.

15 Q. What is the contingency that you used  
16 for Darlington, does 18 per cent sound familiar to you?

17 A. I don't recall exactly, but I would  
18 expect it would be about 20 per cent. Again, it's not  
19 an undertaking that has too many unknowns and the main  
20 point I made in my direct evidence, that we have gained  
21 enormous knowledge in literally taking pressure tubes  
22 out of the reactor and putting them back, so -- and  
23 that's probably one of the most difficult things to do.

24 And as I know this report describes and  
25 also the ONCI document describes in considerable detail

1       how we will cut up the reactor core using water as a  
2       shielding.

3                   Q.   Just like the used fuel repository,  
4       the farther out into the future decommissioning gets  
5       the less expensive it gets; right?

6                   A.   No.  No, that's not true at all.  The  
7       provision is small--

8                   Q.   Yes.

9                   A.   --on a year-by-year basis, and the  
10      effect on levelized unit energy cost over the life of  
11      the plant is small.

12                  Q.   Yes.

13                  A.   But the cost is the cost.  I mean, in  
14      today's dollars, we've been just reviewing this  
15      afternoon what the cost would be.  Now, obviously in  
16      future dollars, in dollars of the year it's going to be  
17      higher--

18                  Q.   But the present value --

19                  A.   --by the amount of inflation that  
20      occurs between now and the year 2060.

21                  Q.   But you would agree that the present  
22      value gets less if you move out farther into the  
23      future?

24                  A.   I'm not quite sure I understand what  
25      you mean by that question.

1 Q. The amount of the cost you work into  
2 the rate base as a percentage of LUEC gets lower if the  
3 decommissioning process is moved farther out?

4 A. Oh, if you decided to decommission  
5 the plant in the year 2100 instead of 2060, I would  
6 agree, yes.

7 But at the present moment we're making  
8 provision on a straight line basis and on the basis  
9 that this provision will earn interest as we go like a  
10 sinking fund of the dates that are given in this table.

11 Q. I understand, Mr. Penn, that the U.K.  
12 has now abandoned plans to dismantle their reactors and  
13 are looking at entombing them for at least 130 years;  
14 is that correct?

15 A. I have no knowledge of that. I'm  
16 afraid I don't know. What I do know is that the South  
17 of Scotland Electricity Board is actually thinking of  
18 extending the life of its AGR reactors.

19 I'm kind of surprised because your  
20 statement -- I'd like to see the article because I  
21 actually was one of the designers of the first Magnox  
22 reactor in Britain and while it's a large structure  
23 it's a rather simple structure.

24 Q. Just for your information, I don't  
25 particularly want to go to it now because I'm trying to

1 finish, but one of the references at least is in  
2 Exhibit 648 and it's at page 64, if you would like to  
3 have a look at that some time.

4 Could we go to Exhibit 521 in the interim  
5 though.

6 A. Well, I notice that this document  
7 you've given is the State of the World in 1992.

8 Q. Yes. Mr. Penn, I asked you the  
9 question --

10 A. I personally prefer to speak to the  
11 people I know in Britain on the subject.

12 Q. That's fine, and you've answered the  
13 question and it's not in your knowledge. That's  
14 satisfactory. I would like to move on, please, to  
15 Exhibit 521.

16 This is another of IPPSO's prefileds and  
17 we have looked at this before, it's title is Evaluating  
18 the Premature Retirement of Nuclear Facilities, A Case  
19 Study.

20 And, again, the author of this paper is a  
21 regulatory program specialist with the California  
22 Public Utilities Commission.

23 MR. MONDROW: Mr. Chairman, I should note  
24 that IPPSO intends in fact to prove this document when  
25 we get to our case, and I'm just going to take the



1 witnesses to a few excerpts, I would just like to get  
2 their comments on.

3 Q. First of all, by way of background,  
4 if we look at the first page, please, the last  
5 paragraph says:

6 "In the second decade of its  
7 operations SONGS 1...", which is the  
8 nuclear station that this report is concerned with:

9 "...began to experience prolonged  
10 periods of non-operation, primarily to  
11 fix and replace equipment and to modify  
12 the facility to comply with federal  
13 regulations."

14 It goes on and talks about the high cost  
15 of maintenance and modifications and relatively poor  
16 performance and the fact that the California Public  
17 Utilities Commission went on - we can see on the next  
18 page - to require the utilities to enter into a  
19 dedicated cost effectiveness hearing in light of a 125  
20 million U.S. dollar upgraded expense that they  
21 announced would be required.

22 Mr. Penn, are you aware of that case?

23 MR. PENN: A. Well, only from reading  
24 this paper and I have noted before in evidence that an  
25 intervenor known as the Division of Ratepayers

1 Advocates was also involved in this case.

2 I believe this plant is quite an old  
3 plant, it's low output, particularly poor capacity. I  
4 don't know if Mr. Daly recalls how low it is.

5 MR. DALY: A. It's lifetime value is 52  
6 per cent.

7 Q. Mr. Penn --

8 MR. PENN: A. That's about all I know  
9 about it.

10 Q. Okay. It's my understanding that the  
11 Division of Ratepayer Advocates is in fact a sub-body  
12 in the California Public Utilities Commission; is that  
13 right?

14 A. I don't know.

15 THE CHAIRMAN: Well, that's what the  
16 paper says.

17 MR. MONDROW: Yes.

18 THE CHAIRMAN: In the next paragraph.

19 MR. MONDROW: Thank you, Mr. Chairman.

20 Q. Going back to page 1, I have already  
21 referred to the last paragraph which referred to  
22 prolonged periods of non-operation experienced at SONGS  
23 1 and, as I already read, primarily to fix and replace  
24 equipment and to modify the facility to comply with  
25 federal regulations.

1                   And that's something that you have  
2                   experienced as well, Mr. Penn, with the Ontario  
3                   reactors; right?

4                   MR. PENN: A. If I interpret this  
5                   sentence to mean that this utility has been compelled  
6                   by the federal regulatory body as a matter of licence  
7                   condition to do something, I wouldn't describe Ontario  
8                   Hydro as ever reaching the point of being compelled; in  
9                   other words, threatened, quite the reverse.

10                  The Atomic Energy Control Board certainly  
11                  brings to our attention things that are of concern to  
12                  them and ask us to respond.

13                  Q. Mr. Penn, you have had to fix and  
14                  replace equipment on your reactors; right?

15                  A. We have where their life has  
16                  prematurely ended, yes.

17                  Q. And you have had to modify your  
18                  facilities to comply with AECB regulations?

19                  A. We have responded to the AECB and  
20                  this is a field that Mr. King is very familiar with.

21                  Q. Yes, and we have heard about that  
22                  before, I'm just confirming that testimony in the  
23                  context of this paper. Could you turn to page 3,  
24                  please.

25                  MR. JOHANSEN: A. Mr. Mondrow, I wonder

1 if I could just add a point further to your question  
2 about the Division of Ratepayers Association. I think  
3 you suggested it was a sub-body of the utility  
4 commission.

5 Q. Yes.

6 A. I believe page 2 of the document,  
7 your Exhibit 521, footnote 3 clarifies its status.

8 In that footnote it indicates that:

9 "As an independent party in these  
10 proceedings the views of the DRA do not  
11 necessarily reflect the views of the CPUC  
12 itself."

13 Q. Yes. And if you look in the second  
14 paragraph on that page, it also says -- in the second  
15 sentence says:

16 "The Division of Ratepayer  
17 Advocates (DRA) a branch of the CPUC  
18 Staff..."

19 [4:10 p.m.]

20 MR. PENN: A. Well, the footnote is  
21 pretty clear, I would say. It's an advocate group that  
22 is funded by the CPUC.

23 Q. We will in fact probably -- IPPSO  
24 does in fact plan to call a witnesses on these matters,  
25 and your counsel can cross-examine that witness about

1 the relationship of the DRA to the CPUC. I appreciate  
2 you pointing out the footnote, Mr. Johansen.

3 Page 3 of the document talks about  
4 capital costs. If you look at the second sentence it  
5 talks about capital additions, and it goes on to  
6 describe the replacement of worn or broken equipment,  
7 tools and upgrades or modifications to comply with  
8 safety requirements or improved reliability.

9 From the context there, Mr. Penn, I would  
10 assume that capital additions are in fact the same  
11 thing as your capital modifications, would you agree?

12 A. I would think that's possibly  
13 correct, yes. I don't know, because they don't really  
14 say what it is they are talking about so far anyway.

15 Q. Well, it says they are talking about  
16 replacement of worn or broken equipment, tools and  
17 upgrades or modifications to comply with safety  
18 requirements or to improve reliability.

19 That would be consonant with Ontario  
20 Hydro's definition of capital modifications; right?

21 A. It could be.

22 Q. And the next sentence says:

23 A typical nuclear plant...

24 And I assume typical in this context is  
25 the U.S. which has smaller plants generally than our



1 CANDU stations.

2 ...will require over one billion in  
3 capital costs over its life after it is  
4 built.

5 Is that consonant with your  
6 understanding, Mr. Penn?

7 A. I imagine they are referring per  
8 reactor, because most plants in the United States are  
9 single reactor plants.

10 Well, as I have given extensive testimony  
11 on this, our position is that we repair or modify or  
12 replace equipment in our plants when it is shown that  
13 it is financially appropriate to do so in the interest  
14 of our customers.

15 Q. Would you agree with the one billion  
16 dollar figure?

17 A. Not necessarily. It may be right.

18 We have just approved an expenditure of  
19 870 million on a 4-unit station. Now whether over the  
20 total life we will spend a billion dollar on every  
21 unit, I don't have that knowledge.

22 Q. Your expenditures on each of the  
23 stations, though, to date is probably roughly  
24 consistent with that figure. I realize that the  
25 station has four units, but you spent about a billion

1 dollar on each of the stations; is that right? At  
2 least on the older "A" series stations?

3 A. I would have to check that. I don't  
4 know.

5 Q. Okay.

6 A. If you include retubing, the answer  
7 is yes.

8 Q. Well, actually I took the numbers  
9 from the two interrogatories that were involved in Mr.  
10 Marcus' prefile which we examined the other day, and as  
11 you know those numbers do not include retubing and I  
12 came out with numbers around a billion dollars. So  
13 that might assist you in checking.

14 A. Well, Mr. Marcus' figures left out  
15 things and included things.

16 Q. I used the interrogatory figures,  
17 Ontario Hydro's figures. So you could look there if  
18 you wanted to check.

19 At any rate, the figures from your ONCI  
20 projections are quite a bit lower than a billion  
21 dollars?

22 A. Well, ONCI is for a future plant.  
23 And most of our capital modifications as we have  
24 testified are associated with - and I won't produce the  
25 page number again from Exhibit 519 - but associated

1 with upgrading heavy water plants, improving security,  
2 updating and upgrading the emergency injection coolant  
3 system at Pickering and at Bruce, et cetera, and these  
4 are non-recurring items.

5 Q. If you look at the second item on  
6 page 3 of this paper, please, it reads:

7 Historically the capital costs of  
8 operating nuclear plants has increased at  
9 a rate greater than inflation. That has  
10 been true of the SONGS 1 plant as well.  
11 However, in its analyses, SEL - Southern  
12 California Edison - assumed that these  
13 incremental capital costs would decrease  
14 in the future.

15 That's in fact what you assume in ONCI;  
16 isn't that right, Mr. Penn?

17 A. Well, I have given testimony on the  
18 expected OM&A over the period that's been right from  
19 1971, right through to the end of the planning period  
20 in the year 2013. I am quite sure you will find  
21 periods where the -- and in constant dollars. And you  
22 will find places where it's a straight line which means  
23 it equals inflation and you will find where it's  
24 dropped so it's less than inflation, and since 1987, as  
25 Mr. Daly has testified, we have significantly increased

1 it to improve our performance.

2 Q. And you have just said --

3 A. And it is increasing at 1 per cent  
4 per annum above constant dollar values on our  
5 assumption from 1992 onwards.

6 Q. And in ONCI you assume that for a  
7 future station these incremental capital costs will  
8 decrease. You have just said that. They are  
9 no-recurring expenditures, your costs go down.

10 A. I was talking about capital  
11 modifications. I thought we were talking about  
12 operating, maintenance and administration costs.

13 Q. We are talking about capital costs.  
14 We are still on the capital costs page here.

15 A. I beg your pardon.

16 Q. No problem.

17 For future you do assume, for ONCI you do  
18 assume that your capital modifications costs will be  
19 lower than they have been, and you have testified as to  
20 why, they are non-recurring expenditures.

21 You have just testified to that, Mr.  
22 Penn.

23 A. For the record I have testified in my  
24 direct evidence, and it is on figure -- what the  
25 current generating system will be.

1 Q. I am talking about your ONCI  
2 projections.

3 A. I want to make sure we have got this  
4 right first.

5 It is on page 67 and it clearly indicates  
6 that the costs are equal to inflation or more than.  
7 And what we are assuming for the future for a future  
8 plant is similar to what we have got for the present  
9 systems from the year 2002 onwards.

10 Q. Doesn't ONCI assume that in the  
11 fourth decade of operation, the capital modifications  
12 to the future plant will be lower than in the previous  
13 decades following your major maintenance?

14 A. No. If you remember, your data  
15 missed out a very important sum of money at year 30,  
16 something like \$400 million.

17 Q. Can you turn to Exhibit 43, page 169,  
18 please.

19 A. That's exactly what I am referring  
20 to. The capital modifications in ONCI --

21 THE CHAIRMAN: Just a moment. Wait until  
22 he asks you a question.

23 MR. PENN: I'm sorry, Mr. Chairman, I  
24 thought that he had already asked it.

25 THE CHAIRMAN: No, he hasn't asked you



1 yet. He just asked you to turn to it. I haven't got  
2 the page open yet.

3 What is the page?

4 MR. MONDROW: The page is 169, Mr.  
5 Chairman.

6 Q. If look at the right-hand column on  
7 that page, Mr. Penn, starting about the middle it says:

8 During year 30 three activities are  
9 assumed to occur.

10 We have been through this before. It  
11 talks about the large scale fuel channel replacement,  
12 plant retirement unit work and inspection and  
13 maintenance.

14 And the following bullet says, the  
15 following paragraph says:

16 This outage will put the station in  
17 better repair and is expected to result  
18 in a capital modification decrease in the  
19 fourth decade.

20 That's correct; isn't it?

21 MR. PENN: A. Well, what it means is  
22 after you have done all this work at year 30, which  
23 again is specified on the left-hand column on page 170  
24 at the bottom, having done all that, having spent all  
25 that money, you won't need in the remaining nine years

1 to spend at the same rate. That's all that means.

2 Q. Yes. Thank you.

3 Back to Exhibit 521, please, page 4. The  
4 second full paragraph on the page the author writes:

5 In addition to underestimating the  
6 likely level of capital requirements for  
7 SONGS 1, Southern California Edison  
8 totally ignored a secondary cost of  
9 adding new equipment. Any new or  
10 replacement machinery added to the plant  
11 to maintain operation will at some point  
12 need to be removed and disposed of.

13 Mr. Penn, for your capital modifications  
14 that you plan to do, have you broken out somewhere the  
15 waste handling and disposal costs specifically  
16 associated the equipment that you remove?

17 A. Well, what we normally do, for  
18 example, pressure tube removal, asbestos removal, PCV  
19 related work, and issues that we know that are going to  
20 come up that need replacement of the equipment, we make  
21 provision for their removal and their disposal. And  
22 the classic example of course is making provision  
23 through the rate process for the pressure tubes, that  
24 includes the removal of them and their disposal, as far  
25 as capital-related equipment is concerned.

1 Q. Excuse me for just a moment.

2 If we can go on in the paper, please, to  
3 page 7, the third paragraph, it says:

4 SONGS 1 operated at an average  
5 capacity factor of about 70 per cent for  
6 the first 10 years of its operation.  
7 However, in the last 10 years its average  
8 capacity factor has been less than 50 per  
9 cent.

10 As Mr. Daly commented on a few minutes  
11 ago.

12 This increase in downtime was  
13 required to implement safety upgrades and  
14 repairs of broken equipment.

15 Mr. Penn, Ontario Hydro has in fact  
16 experienced significant capacity factor decreases due  
17 to retubing outages, for example, and other required  
18 regulatory or safety concern retrofits; is that right?  
19 Certainly not to this degree, not down to 50 per cent,  
20 but it has been an important factor, hasn't it?

21 Q. Well, I would have to ask Mr. Daly to  
22 speak on this question. But yes, we have taken outages  
23 to replace pressure tubes and we have taken the  
24 opportunity to make safety-related retrofits and  
25 replacement of other conventional equipment during that

1 time.

2 Now, I am quite sure there have been  
3 unplanned outages where we have replaced equipment, and  
4 maybe I can ask Mr. Daly to comment on that.

5 MR. DALY: A. Well, that's certainly  
6 true, although most of the major replacements are done  
7 during planned outages.

8 I testified earlier that following the  
9 retubing and rehabilitation of Pickering 1, 2 and 3, we  
10 had returned those units to 75 per cent.

11 I might note that this SONGS 1 is about  
12 the same generation as Douglas Point. In fact, I think  
13 it was put into service about a year before Douglas  
14 Point, so their experience with SONGS 1 seems more  
15 equivalent to our experience with Douglas Point.

16 Q. Pickering is coming up on 20 years,  
17 Pickering "A"; is that right?

18 A. The first unit was '71, yes.

19 Q. And the San Onofre nuclear generating  
20 station 1, SONGS 1, will be operating 24 years when  
21 it's shut down. That's your understanding of SONGS 1?

22 A. My understanding is it came in  
23 service in '67.

24 Q. Could you turn to page 16, please.

25 The California Public Utilities Commission ultimately

1 concluded that shutting SONGS 1 down would save the  
2 ratepayers almost \$500 million.

3 You can see that in the last sentence  
4 above the conclusion segment on the page.

5 Following that, and in light of the  
6 experience that the author had with the inquiry and its  
7 outcome, about halfway down the first paragraph under  
8 the conclusion he posits:

9 In particular, nuclear units which  
10 have relatively poor performance or which  
11 require significant capital expenditures  
12 should be closely scrutinized for  
13 cost-effectiveness.

14 Mr. Penn, you have a few units which  
15 follow at least into the second category. Would you  
16 agree with that conclusion?

17 MR. PENN: A. I agree entirely and I  
18 gave testimony that we had done financial tests before  
19 we undertook or sought approval of the rehabilitation  
20 capital modification cost to Bruce "A", and that there  
21 was a significant advantage in net present value of  
22 carrying through with repair.

23 Q. Mr. Penn, building a nuclear plant  
24 entails significant financial risks; doesn't it?

25 A. Well, any undertaking that involves a



1 large expenditure of capital over a considerable period  
2 of time necessarily involves risk.

3 Q. And nuclear stations do involve a  
4 large expenditure of capital and that expenditure does  
5 occur over a significant amount of time, you have  
6 testified to that.

7 A. So do fossil stations, so do  
8 hydroelectric stations, so does building the SkyDome.

9 Q. Could you turn to page 14 of the  
10 paper. If you had a chance to read this paper it's  
11 pretty clear throughout that an underlying theme is a  
12 discussion of the accounting and analytical  
13 machinations that Southern California Edison went  
14 through as subsequently uncovered by the CPUC to  
15 justify the continued operation of SONGS 1.

16 I am just going to take you to a portion  
17 where the author posits a possible reason for these  
18 various accounting practices.

19 About the middle of the way through the  
20 first paragraph under utility accountability, the  
21 author writes:

22 One answer is that under typical cost  
23 recovery practices utilities are not at  
24 risk if their forecasts or decisions turn  
25 out to be wrong.

1  
2 Mr. Penn, isn't it true that no nuclear  
3 facility has ever been built anywhere by any utility  
4 that couldn't rely on costs passed through to the  
5 ratepayers?

6 A. Well, that is a very broad statement.

7 I would agree with you in monopolistic  
8 situations, but where utilities are privately owned,  
9 and these are in a number of places in the world,  
10 particularly in the United States, I'm not sure that  
11 that is entirely the case. But I really don't know,  
12 quite frankly.

13 Q. Isn't it true that every time a  
14 regulatory body has required the shareholders of a  
15 privately-owned utility to take the cost risks, the  
16 utility has decided not to proceed with nuclear plants?

17 A. I don't know the answer to that  
18 question. I don't have the knowledge.

19 MR. MONDROW: Thank you, gentlemen.

20 Mr. Chairman, those are my questions.

21 THE CHAIRMAN: Thank you, Mr. Mondrow.

22 Do you want to start, Mr. Campbell?

23 MR. M. CAMPBELL: There is half an hour  
24 to go. My difficulty is that tomorrow at ten o'clock  
25 Ms. Spoel for the Voice of Women wishes to proceed for

1 about an hour or so, so not only would I be shifted  
2 over the evening, I would be losing an hour tomorrow  
3 morning.

4 I would probably prefer to start tomorrow  
5 at around eleven.

6 THE CHAIRMAN: To coin a phrase, I will  
7 leave it in your hands. You can have your choice.

8 MR. M. CAMPBELL: In that case tomorrow  
9 at eleven.

10 Perhaps I could use the time very briefly  
11 with Ms. Harvie to make sure the panel has all the  
12 documents.

13 THE CHAIRMAN: We will adjourn until  
14 tomorrow morning at ten o'clock.

15 THE REGISTRAR: Please come to order.  
16 This hearing will adjourn until ten o'clock tomorrow  
17 morning.

18 ---Whereupon the hearing was adjourned at 4:30 p.m., to  
19 be reconvened on Tuesday, May 5, 1992, at  
20 10:00 a.m.







